Eskom	**UMQULU WEENKCUKACHA WOLUNTU**	**UbuNjineli beNyukliya**

Itayitile: **UMqulu weeNkcukacha woLuntu oXhasa iSicelo seLayisenisi ka-Eskom seNdawo yokuFaka iNukliya kwiNdawo i-Thyspunt**

Isikhangeli esiNgafani nezinye:	**240-147175950**
Enye iNombolo ekungaJoliswa kuyo:	**N/A**
Indawo apho kuSetyenzwa khona:	**UbuNjineli beNyukliya**
Uhlobo loMqulu:	**PID**
Ukuphinda-phinda:	**1**
Inani lonke lamaphepha:	**129**
Umhla oLandelayo wokuPhinda kujongwe:	**N/A**
Ukuvezwa koHlelo:	**UHLELO LOLUNTU**

Yenziwe ngu	**UXanduva lokuSebenza**	**Igunyaziswe ngu**
……..	……..	……..
A. Kilian	**S Touffie**	**R Bakardien**
USosayensi oPhezulu, iZifundo zeeNdawo zeNyukliya	**UManejala Jikelele [Ibambela] Ubunjineli beNyukliya**	**IGosa eliyiNtloko yeNyukliya**
Umhla: ……	Umhla: ……	Umhla: ……

ISISHWANKATHELO SOLAWULO

IMVELAPHI NENKCAZA NGEPROJEKTHI

U-Eskom Holdings (SOC) Limited ufake isicelo, ngokubhekiselele kwimithetho R.927 (imithetho yokulayisenisa iindawo zokufaka inyukliya ezintsha), yelayisenisi yokufaka inyukliya endaweni (NISL) oku kusenzelwa indawo i-Thyspunt. Injongo yesicelo se-NISL kukulayisenisa i-Thyspunt njengendawo yenyukliya ukuze ifake inyukliya entsha/iinyukliya ezintsha.

Isicelo se-NISL silingana nesicelo semvume yakwangoko yendawo (ESP- umlenze wokuphinda kujongwe iNgxelo yoHlolo loKhuseleko) e-United States, ngokuthi indawo ibe ingalayiseniswa, ezimeleyo kuyilo lweziko lamandla elikhethekileyo, njengoko kufanele ukwenziwa kunye nenkqubo yeziko lamandla lenyukliya.

Olu Xwebhu lweeNkcukacha loLuntu (PID) lusebenza ukunika amalungu oluntu iinkcukacha ekuhlalutyeni nokuhlolo oluxhasa isicelo sika-Eskom NISL.

Izinto ezikhethekileyo ezibhekiselele kuyilo lokufakwa kwenyukliya aludibananga nesicelo se-NISL. Licebo lika-Eskom lokulandela ukufaka isicelo seelayisenisi zokufakwa kwenyukliya zokwakha nokwenza iinkqubo zokufaka iinyukliya ezininzi endaweni, ngexesha apho u-Eskom aza kuba efuneka anike iinkcukacha zoyilo nobume bendawo. Nangona kunjalo, ukubonisa ukulandela iimfuno ze-NNR, kwezinye izinto, umlinganiselo weradiyoloji kunye nomngcipheko, uyilo oluyintshayelelo kunye neenkcukacha zenkqubo ziye zasetyenziswa kwiNgxelo yeNdawo yoKhuselo ye-Thyspunt - [Thyspunt Site Safety Report (TSSR)]. Nanjengoko i-TSSR isekwe kwiinkcukacha ezijolise kwisiza eso kunye neenkcukacha eziquka ezangaphambili, kwisiphakamiso sokufakwa kwenyukliya, izigqibo ze-TSSR ziza kuqinisekiswa luhlalutyo lokhuseleko oluchazayo, olwenziwa ukuxhasa isicelo eso seelayisenisi ezilandelayo zokufakwa kwenyukliya.

UKUCHAZWA KWENDAWO

Indawo yase-Thyspunt ime kumazantsi agudle unxweme eMzantsi Afrika, malunga neekhilomitha ezine, empuma ye- Oyster Bay, kwiikhilomitha ezili-12 entshona ye-St. Francis Bay kwakunye namalunga ne- 17,3 eekhilomitha emazantsi e-Humansdorp (imigama ikalwa ukusuka embindini wesiza ukuya kumda wedolophu ekufutshane).

Akukho hola beendlela bakhwelangaphezu kwabanye abanqumla kule ndawo. Owona mgaqo ufikelela kule ndawo yindledlana engalungiswanga eya e-Oyster Bay. Enye indlela igqitha umgaqo ongalungiswanga, ophuma usuka emgaqweni wetha u-R330 osuka e-Humansdorp usiya e- St. Francis Bay.

Amabala eenqwelo-moya akulo mmandla ngawona omeleleyo namancinane amabala eenqwelo-moya yaye enzelwe ukuhlala kweenqwelo-ntaka zongxamiseko eziya ezifama. Ikakhulu kukho amaziko angabhaliswanga, asetyenziswa ngabantu ngokwabo kwimisebenzi yabo yabucala,

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yaye akukho zakhiwo nabuxhakaxhaka. IZiko leeNqwelo-moya laseBhayi i-Port Elizabeth International Airport, elime kwiikhilomitha ezingama- 85 ukuya empuma yale ndawo, lelona ziko leenqwelo-ntaka likufutshane kule ndawo. Akukho maziko omkhosi akumgama wama 80 eekhilomitha kule ndawo.

Akukho mizila kaloliwe enqumla kule ndawo.

IBhayi kunye neNgqura (Coega) zizikhululo zeenqanawa ezime ngaphaya kwama- 80 eekhilomitha ukusuka kule ndawo, zezona zikhululo zoshishino kummandla webhoda. Isikhululo seenqanawa esincinanane e-Cape St. Francis, esimi kwikikhilomitha ezili- 13,9 ukuya empuma, sinendawo engena emanzini, enesitya soshishino sokuloba iintlanzi, neentsika ezenziwa ngekhonkrithi kunye nendawo yokungena isikhephe ukulungiselela izikhephe zokuzonwabisa.

UKUQINISEKISA UKHUSELEKO

Indawo yase-Thyspunt iphandwe ngokuphangaleleyo ngokubhekiselele kwiimpawu zonke zendawo ezinokuthi ziphazamisane nokhuseleko ekufakweni kwale nyukliya iphakanyisiweyo ukuba ifakwe okanye iinyukliya eziphakanyisiweyo. Ukongeza, imicimbi ekungenzeka ibe negalelo yeradiyoloji, kwiimeko zenkqubo eziqhelekileyo kunye neemeko zengozi nazo ziye zahlolwa.

Iindlela ezifanelekileyo ezilandela iikhowudi namanqanaba ehlabathi kunye nokhuseleko ziye zalandelwa zaza zenziwa kuko konke. Umzekelo, iimeko zobugcisa neendlela, ikomiti ephezulu yokuqwalasela iinyikima nokuhlola imingcipheko (SSHAC). Indlela yenqanaba 3 iye yalandelwa ukubonisa ukuba kungabakho iinyikima na kule ndawo.

Ngokubhekiselele kwezi zifundo, zithe zenziwa, kuqukumbelwe ngelithi, izehlo zendalo nezenziwa ngabantu zisuka ngaphandle, ezibhekiselele kwindawo i-Thyspunt azikwazi kuvalela le ndawo ekubeni kusekwe iziko lokufaka inyukliya. Izehlo zangaphandle mhlawumbi bekuba zezi:

- Kuhlolwe ukuba ziqwalaselwe ngakumbi xa kuyilwa;
- Kuhlolwe ngokubhekiselele ekubeni isimo siqinisekiswe xa kukhethwa uyilo olukhethekileyo, okanye
- Siza kunikwa imbuyekezo ngokwezi ndlela:
    - Uyilo oluthile lokufakwa kwenyukliya eqikelelwayo okanye
    - Amanyathelo okhuseleko lwendawo.

Xa kuhlolwa indawo ukuze kubonwe igalelo elingenzeka leradiyoloji, kwindawo ekulo ngingqi xa kuqhutywa iinkqubo kunye neemeko zengozi, umlinganiselo woqikelelo olufanelekileyo lokuza kwenzeka okanye izinto ezingaphuma apho, ngenxa yeradiyoloji kuye kwafunyanwa, kuthathwa amanyathelo okuvala iimpawu zamaziko aphakanyisiweyo ukuze enziwe kwindawo leyo kwakunye nezinto ezilungiselela ukhuseleko.

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Indlela ekungaya ngazo izinto ezenziwa yinkqubo yeradiyoloji, ngqo nezo zingahambi ngqo, ezingafika yaye zichaphazele abantu kunye noko kungqongileyo ziye zaphandwa yaye zahlolwa, kuthathelwa ingqalelo iimpawo ezikhethekileyo zengingqi leyo kunye nale ndawo.

Uhlolo lomlinganiselo weradiyoloji lubonisa ukuba umlinganiselo osebenzayo wonyaka ukuya kwiqela elibalulekileyo lendalo elibhekiselele kwinkqubo eqhelekileyo kwaye nezinto ezincinane ezehlayo zingaphantsi kwama- 72 µSv/a. oku kuqinisekisa ukuba indawo ikufanele ukwakha inyukliya/iinyukliya ezintsha eziza kufakwa yaye umlinganiselo wonyaka oya eluntwini uza kuba phakathi kweemfuno zoxinzelelo lomlinganiselo wama- 250 µSv/a ongumlinganiselo woMthetho weNyukliya weLizwe .

Ukuhlolwa kokulungela nokuphendula kungxamiseko kugqibe kwelokuba akukho miqobo ibonakalayo engaba negalelo ekusekweni nakuphuhliso lwesicwangciso songxamiseko. Kukhuthazwa ukuba kuqhutywe ulawulo lomthetho kunye/ nokuhlolwa kophuhliso kwiindawo ekucwangciswa kuzo ungxamiseko olujikeleze le ndawo.

ISIPHELO

Iinkcukacha zohlalutyo nokuhlolwa okwenziweyo ukuhlola ukufaneleka kwendawo yase-Thyspunt kubhalwe kwiNgxelo yoKhuseleko lweNdawo yase-Thyspunt. Ubume obuqondakalayo bezifundo kunye nokukhuthala oku ebekusenzeka ngako, kuthethelela isicelo se-NISL sika-Eskom. Kuthathwe inkathalo ukuqinisekisa ukuba zonke izinto ezinobungozi , ezinokukhokhelela kutshintso ziyabonwa yaye igalelo lazo lotshintsho elayamene neradiyoloji lubekwe ezantsi apho lufikeleleka kangangoko. Ngako oko kungagqitywa ekubeni:

- Umlinganiselo weradiyoloji oya eluntwini uza kuba ngovumeleke waba phantsi yaye ukwimida esemthethweni.
- Akukho miqobo ibonakalayo kuphuhliso lwesicwangciso songxamiseko ezithe zabonwa.
- Zonke izinto ezinobungozi zahlolwa futhi zaxilongwa okanye kungajongwana nazo kuyilo lokufakwa kwenyukliya.
- Amanyathelo afanelekileyo okhuseleko angenziwa.
- Akukho zinkcukacha ezingaqhelekanga okanye ezimbi kakhulu okanye mikhuba ithe yafunyanwa.

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UFINYEZO-MAGAMA

UFINYEZO-MAGAMA	INKCAZELO
AADQ	Annual Allowable Discharge Quantity
AC	Alternating Current
ADS	Automatic Depressurisation System
ALARA	As Low As Reasonably Achievable
APC	Airplane Crash
ASME	American Society of Mechanical Engineers
BLEVE	Boiling Liquid Expanding Vapour Explosion
CAA	Civil Aviation Authority
CCWS	Component Cooling Water System
CED	Committed Effective Dose
CFR	Code of Federal Regulations
CHRS	Containment Heat Removal System
CISF	Central Interim Storage Facility
COL	Combined Operating Licence
CP	Construction Permit
CSS	Containment Spray System
CVCS	Chemical and Volume Control System
DSA	Deterministic Safety Analysis
EA	Environmental Authorisation
EAD	Environment Agency – Abu Dhabi
EFWS	Emergency Feed Water System
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
ENEC	Emirates Nuclear Energy Corporation
EP	Emergency Planning
EPD	Electronic Personal Dosimeter (EPD)
EPR	European Pressurised Water Reactor
EPRI	Electric Power Research Institute
EPZ	Emergency Planning Zone
ESP	Early Site Permit
EUR	European Utility Requirements
EZ	Exclusion Zone
FANR	Federal Authority for Nuclear Regulation

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FAR	Federal Aviation Regulatory
FB	Fuel Building
FPCPS	Fuel Pool Cooling and Purification System
GAL	Generic Action Level
GIL	Generic Intervention Level
GMC	Ground Motion Characterisation
GMRS	Ground Motion Response Spectrum
GWh	Gigawatt hour
HLW	High Level Waste (Heat generating radioactive waste with high long- and short-lived radionuclide concentration)
HV	High Voltage
HVAC	Heat, Ventilation, and Air Conditioning
I&C	Instrumentation and Control (System)
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life or Health
ILW	Intermediate Level Waste
INSAG	International Nuclear Safety Advisory Group
IRP	Integrated Resource Plan
IRWST	In-Containment Refuelling Water Storage Tank
ISI	In-Service Inspection
ISO	International Organisation for Standardisation
IST	In-Service Testing
JPC	Joint Planning Committee
kA	Kiloampere
KNPS	Koeberg Nuclear Power Station
kV	Kilovolt
LCR	Licence Change Request
LFL	Lower Flammable Limit
LLW	Low Level Waste
LNT	Linear No-Threshold Model
LOCA	Loss of Coolant Accident
LOOP	Loss Of Offsite Power
LPZ	Long-Term Protective Action Zone
LRF	Large Release Fraction

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LWR	Light Water Reactor
MeV	Mega electron Volts
MOX	Mixed Oxide
mSv	Millisievert
MTU	Megaton of Uranium
MW	Megawatt
MWe	Megawatt (electrical)
MWh	Megawatt hour
MWth	Megawatt (thermal)
NAB	Nuclear Auxiliary Building
NECSA	The South African Nuclear Energy Corporation
NEMA	National Environmental Management Act
NISL	Nuclear Installation Site Licence
NKP	National Key Point
NIL	Nuclear Installation Licence
NM	Nautical Miles
NNR	National Nuclear Regulator
NPP	Nuclear Power Plant
NPS	Nuclear Power Station
OSP	Operational Support Development Programme
OTS	Operating Technical Specifications
PCCS	Passive Containment Cooling System
PEIA	Port Elizabeth International Airport
PID	Public Information Document
PP	Position Paper
PPE	Plant Parameter Envelope
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSHA	Probabilistic Seismic Hazard Analysis
PSM	Power Station Manager
PWR	Pressurised Water Reactor
QRA	Quantitative Risk Assessment
RAP	Representative Animal and Plant
RB	Reactor Building
RCCA	Rod Cluster Control Assembly

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UFINYEZO-MAGAMA	INKCAZELO
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RD	Regulatory Requirements Documents
RF	Radio Frequency
RG	Regulatory Guide
RP	Radiation Protection
RPC	Radiation Protection Certificate
RPP	Radiation Protection Programme
SAB	Safeguard Auxiliary Building
SABS	South African Bureau of Standards
SAMSA	South African Maritime Safety Authority
SANS	South African National Standards
SAR	Safety Analysis Report
SBO	Station Blackout
SC	Safety Case
SG	Steam Generator
SIS	Safety Injection System
SSA	State Security Agency
SSHAC	Senior Seismic Hazard Analysis Committee
SSR	Site Safety Report
STP	Sewerage Treatment Plant
TCA	Terminal Control Area
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent Detector
TMI	Three Mile Island
TRITON	Transport Rigor Implemented with Time-Dependent Operation for Neutronic Depletion.
TSSR	Thyspunt Site Safety Report
UAE	United Arab Emirates
UFP	Used Fuel Pool
USA	United States of America
USNRC	United States Nuclear Regulatory Commission
UV	Ultraviolet
VEGP	Vogtle Electric Generating Plant
W-C	Wolff-Chaikoff
WHO	World Health Organisation

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IIMPAWU EZIDIBENEYO

UMDIBANISO	Inkcazelo
KI	Potassium Iodide
KIO_3	Potassium Iodate
NIS	Sodium-iodide symporter
CO_2	Carbon dioxide
UO_2	Uranium dioxide

INKCAZELO

Igama ebizwa ngalo	Inkcazelo
Burn-up	The total heat energy extracted per unit weight of fuel, preferably expressed in Megawatt-hour per kilogram of Uranium (MWh/kgU) or Megawatt-day per megaton of uranium (MWD/MTU). (Note: MWh is thermal energy not electrical energy.)
Committed effective dose (CED)	The quantity $E(\tau)$ is defined as: $E(\tau) = \sum_T w_T \times H_T(\tau)$ ..... Eqn 1 Where: $H_T(\tau)$ is is the committed equivalent dose to tissue or organ T over the integrated time τ that elapsed after an intake of radioactive substance. W_T is the tissue weighting factor for tissue or organ T. When τ is not specified it is taken to be 50 years for adults and the duration of intake for children to be 70 years.
Constraint	A prospective and source related value of individual dose (dose constraint) or of individual risk (risk constraint) that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization. i) For occupational exposure, a constraint on individual dose to workers established and used by registrants and licensees to set the range of options in optimizing protection and safety for the source. ii) For public exposure, the dose constraint is a source related value established or approved by the government or the regulatory body, with account taken of the doses from planned operations of all sources under control. iii) The dose constraint for each particular source is intended, among other things, to ensure that the sum of doses from planned operations for all sources under control remains within the dose limit. iv) For medical exposure, the dose constraint is a source related value used in optimizing the protection of carers and comforters of patients undergoing radiological procedures, and the protection of volunteers subject to exposure as part of a programme of biomedical research. v) The risk constraint is a source related value that provides a basic level of protection for the individuals most at risk from a source. This risk is a function of the probability of an

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Igama ebizwa ngalo	Inkcazelo
	unintended event causing a dose and the probability of the detriment due to such a dose. Risk constraints correspond to dose constraints but apply to potential exposure.
Umlinganiselo	A measure of the energy deposited by radiation in a target.
Umlinganiselo osebenzayo	The quantity E, which defined as a summation of the tissue or organ equivalent doses, each multiplied by the appropriate tissue weighting factor: $E = \sum_T w_T \times H_T$ ..... Eqn 2 Where: H_T is the equivalent dose in tissue or organ T and, w_T is the tissue weighting for tissue or organ T.
Ukwandisa	Any process that artificially increases the fraction of U-235 in a mixture of Uranium Isotopes to levels higher than what is found in nature, given that in nature U-238 constitutes about 99,274% and U-235 about 0,720%. There are other isotopes such as U-234 and U-236, but these only make up a small fraction e.g. U-234 only constitutes 0,005%. The balance is made up of U-232, U-233, and U-236.
Irradiated fuel	Nuclear fuel that has been exposed to neutron radiation in a nuclear reactor, but not necessarily to design burnup.
Ukwahlulwa kwenyukliya	Nuclear fission occurs when a nucleus of an atom breaks into two or more nuclei.
Nuclear installation site licence (NISL)	A nuclear authorisation for a nuclear site that is earmarked for the siting, construction, and operation of one or multiple nuclear facilities. Individual nuclear licences are required for each nuclear facility being constructed on the nuclear site.
Probability	The likelihood of an event occurring.
Probabilistic risk assessment (PRA)	A qualitative and quantitative assessment of the risk associated with plant or facility operation and maintenance that is measured in terms of frequency of occurrence of risk metrics, such as release category frequency and its effects on the health of the public [also referred to as a probabilistic safety assessment (PSA) or quantitative risk assessment (QRA)].
Projected dose	The dose that would be expected to be received if planned protective actions were not taken.
Reference accident	A selected accident that envelops the set of accidents that can reasonably be foreseen in the safety analysis (refer to RG-0011).
Reference animal or plant (RAP)	A hypothetical entity with the assumed basic biological characteristics of a particular type of animal or plant (as described to the generality of the taxonomic level of family) with defined anatomical, physiological and life history properties. A RAP can be used for the purposes of relating exposure to dose and dose to effects, for that type of living organism.
Representative person	An individual, who will almost always be a hypothetical construct, receives a dose that is representative of the more highly exposed individuals in the population. The representative person is equivalent to, and replaces, the average number of the critical group.

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Igama ebizwa ngalo	Inkcazelo
Umngcipheko	Refers to the frequency and consequences of an event, as expressed by the “risk triplet” that answers the following three questions: • *What* can go wrong? • How *likely* is it? And • What are the *consequences* if it occurs?
Echithwe okanye esetyenziwe emafutheni .	Nuclear fuel that has been irradiated in a nuclear reactor to the point where the fuel is no longer useful in sustaining a nuclear reaction. The fuel is removed from the reactor core and stored underwater in storage racks in spent fuel pools.
Stochastic effects	Those effects for which the probability of occurrence increases with dose, for which there is no threshold where they will occur.
Source term	The fractions defining the portion of the radionuclide inventory in the reactor at the start of an accident that is released to the environment. Also included in the source term are the initial elevation, energy, and timing of the release.

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1 INJONGO NOMDA

Iinjongo zalo mqulu kukunika amalungu oluntu iinkcukacha ngokubhekiselele kubume bokufaka isicelo selayisenisi yendawo yokufaka inyukliya (NISL) kwindawo yase-Thyspunt. Umqulu unika ubume beprojekthi ngokubanzi, inkcazelo yeengozi ezingabakho ngenxa yokuvezwa kwimitha ekrazulayo, iinkcukacha ezibanzi zenqanaba lohlobo lobuchwepheshe obunokuba kuloo ndawo, kuqwalaselwa iipharamitha ezikhethekileyo ukulungelana neempawu zendawo, inkcazelo yendawo kunye nokuthethelelwa kokufaneleka kwayo, izinto ezixhasa imeko yokhuseleko, ukuhlolwa kokuba lungenzeka na uphuhliso nokuqhutywa kwesicwangciso songxamiseko, iinkcukacha malunga nolawulo lwenkunkuma kunye nokupheliswa kwayo, inkcazelo ngamanyathelo othutho kunye nokunikwa kothutho olukhuselekileyo kunye nezinto ezinemitha ye-athom.

Isicelo se-NISL application is limited to the evaluation of the suitability of a site for new nuclear installations and this is done in accordance with regulations on licensing of sites for new nuclear installations (Regulation R.927). Inkqubo leinika ithuba lokuba lowo ufake isicelo acele igunya lo gama kungekho khetho loyilo olukhethekileyo, ngokujonga ukufaka kwenyukliya enento yonke edla ngokuthi ixesha elininzi ibekho kwindawo (ekwabizwa ngohlobo lwe-Plant Parameter Envelope). Olu hlobo lusetyenziswa ukunika izinto zasemaphethelweni kwimiba yendawo kwasekuqaleni, apho isigqibo ngoyilo lwesixhobo esiveza oko singekabikho. Ngokwenye indawo yesicelo, ukulandelwa kwemithetho kufuneka kubonakale kwi-NNR, ukuba imiba yendawo ehambelanayo ibonakaliswe ngokufanelekileyo yaye yahlolwa ukuze imelane nemiba yokhuseleko kwaye ubungozi eluntwini obusuka ekufakweni kwazo zonke iinyukliya buza kuza kancinane kangangoko (ALARA).

Ilayisenisi yokufakwa kwenyukliya (NIL) imele igunya elisezantsi lokwakhiwa, inkqubo, ukulungiswa, decontamination, and decommissioning kokufakwa kwenyukliya ngokusekwe kuyilo olukhethekileyo. I- PID ehambelana nesicelo esikhethekileyo se-NIL iza kwenziwa kwakuba kwenziwe isicelo se-NIL.

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2 IMVELAPHI

Kumazwe amaninzi, kuquka noMzantsi Afrika, ukukhula koqoqosho neemfuno zasekuhlaleni, zikhokhelela kwimfuneko enkulu yamandla nangona kuqhutyelwa phambili ukusetyenziswa kakuhle amandla ombane. Ngenxa yoko, imfuneko enkulu yamandla ombane kufuneka kumelwene nayo ngokuthi kufakwe amandla amatsha. U-Eskom ngumvelisi osisiseko wamandla nomniki-mandla woMzantsi Afrika. U-Eskom ufake isicelo se-NISL ngokuhambelana nomgaqo-siseko wamandla enyukliya ka-2008, ofuna umnini-ndawo weziko lokuphehla amandla lenyukliya kunye nalowo uqhuba inkqubo yophehlo yenyukliya ukuba aqinisekise ukuba iindawo zokwakha amaziko ophehlo-mandla enyukliya kwixesha elizayo, zikhona, zikhuselekile yaye zigunyazisiwe ngaphambi kokuba uxenzelelo lophuhliso luzenze zingafaneleki okanye lwenze nzima ukhuselo oluluqilima kunye nesicwangciso songxamiseko.

Isicelo se-NISL yi…… precursor ye- NIL ukuze iqhube kwaye yakhe isitishi samandla senyukliya kwindawo yase-Thyspunt.

2.1 IINDAWO ZEPROJEKTHI EZIFANAYO ZENYUKLIYA KWIHLABATHI JIKELELE

Ukubekwa kwendawo yokufaka inyukliya yinkqubo ebaluleke kakhulu nanjengoko ingachaphazela ngamandla iindleko, ukwamkelwa luluntu kunye nokhuseleko ekufakweni kwayo kwixesha lobomi bayo lo gama iqhuba.

Inkqubo yokubekwa kwenyukliya yinkqubo echazwe kakuhle kakhulu. Amazwe ahluka-hlukeneyo athathe ezi nkqubo zokubeka iinyukliya,elandela imipoposho ye-International Atomic Energy (IAEA) efana ne- IAEA's SSG-35 (Ukukopolwa kweNdawo nokuKhethwa kwayo), NG-T-3.7 (ukuLawula iMisebenzi yeNdawo kwiiNdawo zoPhehlo lwaMandla eNyukliya), SSR-1 (Ukuhlolwa kweNdawo ukuze kuFakwe iNyukliya), Amaziko oPhando lwaMandla oMbane [Electric Power Research Institute's (EPRI)] isikhokhelo sendawo kunye ne-United States Nuclear Regulatory Commission's (USNRC) 10 CFR Indawo 100; 10 CFR Indawo 51; 10 CFR Indawo 52 nezinye.

Ngokubhekiselele ekubekweni kwendawo nokuhlolwa kwayo, lamazwe abonisa iindlela ezifanayo kwinqanaba eliphezulu ngokubhekiselele kumgaqo-siseko okanye inkqubo kodwa ahluka ….. kwinqanaba lokujonga iinkcukacha. Ukukhethwa kwendawo kupasiswa ngendlela enye okanye ezininzi, nangona kungasoloko kungenxa yomlawuli wokhuseleko lweenyukliya futhi oku kungasoloko kusenziwa ngokusemthethweni. Ngamanye amaxesha kuyekufuneke kuqwalaselweukuba kuthathwe ezinye iindawo.

Ukuhlolwa kwendawo nemisebenzi yokulungiswa ichjazwe ngokubanzi yayeilawulwa ngumlawuli wokhuseleko lwenyukliya. Ngokubanzi, imiba yokuhlolwa kwendawo kwi- IAEA SSR-1 ijongwa kuwo onke amazwe, nangona ikakhulu kuba ngenxa yokutolikwa kwasekuhlaleni. Kuyinto eqhelekileyo ukwenza uhlolo lokungqongileyo ukuze kujongwe igalelo lesitishi samandla kwindawo engqongileyo kunye negalelo lendawo yamandla nendawo engqongileyo kwisitishi samandla.

Izifundo ezibini, esinye isese-brownfield site (indawo ebihleli ikhona enobuxhaka-xhaka beziko lophehlo] kunye nenye indawo-greenfield site (indawo entsha engenabuxhaka-xhaka

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bezikolophehlo) eku ,,,,on the execution kweprojekthi yendawo yophehlo kwihlabathi, kuchazwe apha ngasezantsi.

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2.1.1 Indawo yophehlo lombane i-Vogtle Electric Generating Plant (VEGP) Indawo (Indawo esetyenziselwa uphehlo kodwa inobugoci-goci)

I-Southern Nuclear Operating Company, Inc. (Southern) ifake isicelo ngomhla we-14 ku-August 2020, ukuze ifumane imvume kkwangoko (ESP), elingana nelayisenisi yendawo yokufakwa kwenyukliya (NISL) eMzantsi Afrika, kwi-USNRC kwindawo ekwi-VEGP, ejongene neeyunithi u- 1 no 2 ze-VEGP ngokubhekiselele kwiimfuno zeTayitile 10 yeKhowudi yeMithetho yoManyano [Code of Federal Regulations], Indawo 52, (10 CFR 52) Indawo engaphantsi A, Iimvume zaKwangoko zeNdawo. Ngomhla we-16 ku-Agasti 2007, isongezelelo sesicelo se-Southern's ESP senziwa kwi-USNRC kusandiswa umda wesicelo ukuze uquke isicelo sokuphunyezwa ukwenza imisebenzi ekhethiweyo yokwakha, ebizwa ngokubanzi ngomsebenzi onemida. Indawo ye- Vogtle ESP kunye nokugunyaziswa komsebenzi onomda, yakhutshwa yi-USNRC ngomhla wama-26 Agasti 2009.

Indawo ye-Vogtle ikwiSithili i-Burke, Georgia, malunga nama 42 eekhilomitha kumzantsi-mpuma we- Augusta, Georgia. I-ESP kukuphunyezwa yi-USNR kweendawo ezingamaziko enyukliya enye okanye ngaphezulu kwaye ayidibananga nokugcwaliswa kwesicelo semvume yokwakha, (CP) okanye ilayisenisi edityanisiweyo (COL) yelo ziko. Injongp yesicelo se- ESP yayikukuba i-USNRC ikwazi ukubona ukuba indawo ye-VEGP izifanele iiyunithi ezintsha (iiyunithi 3 no 4 ze-VEGP) ngokusombulula eminye imiba yokhuseleko neyokungqongileyo ngaphambi kokuba i-Southern ithathe ubukhulu bexesha elongeziweyo kunye nendleko yokuyila nokukhangela ukuvunywa kokwakha elo ziko kuloo ndawo. Indawo yama- 52 yeTayitile ye-10 i-CFR "njengenxalenye yemvume yokwakha". Lowo ufaka isicelo se-CP okanye i-COL seendawo zophehlo lwamandla enyukliya ezizakuba sendaweni apho i-ESP yakhutshwa khona angathi alathe i-ESP, ngako oko esusa ukuphinda kujongwe imiba kweso sigaba senkqubo yelayisenisi.

Ukuphinda kujongwe kunye nokuphunyezwa kwendawo yokwakha kunye nenkqubo yophehlo lwamandla enyukliya (NPP) kuqhutywa yi- USNRC iqwalasele ukukhuselwa kwimitha, ukuvunywa kwezinto ezininzi zezinye ii-arhente zasekuhlaleni, ezelizwe, ezeentlanga kunye nee-arhente zeemanyano nazo zingafuneka.

Uphononongo lokhuseleko lwe-ESP lubhekiselele kukhuseleko lwendawo kunye nesicwangciso songxamiseko. Imiba eqwalaselwayo iquka:

- Inkcazelo yendawo
- Ukuhlolwa kweempawu zendawo ezichaphazela uyilo lweziko, kuquka ukuhlalutywa kweenkqubo ezinkulu, ulwakhiwo kunye namacandelo athwele okubalulekileyo ekwamkelekeni kwendawo;
- Iimpawu ezibonakalayo zendawo ezingathintela uphuhliso kunye nokwenziwa kwesicwanngciso esifanelekileyo songxamiseko,
- Iinyikima,ubume bemozulu, ukuma kwendawo kunye neempawu zokuhanjiswa kwamanzi kuloo ndawo.

Iimpawu zendawo, iinkqubo zokuthengisa kunye nokuqinisekiswa komgangatho, konke oko kulungele inkqubo yokuhlolwa ye-USNRC. Ingxelo yoHlalutyo loKhuseleko lweNdawo,

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kuthathelwa ingqalelo iiMpawu zeNdawo, ithi ifakwe njengendawo yokufaka isecelo ye-ESP ukuze kuhlalutywe yaye kwamkelwe ngabomthetho.

Uhlalutyo lokungqongileyo okuphelelisa uhphononongo lokhuseleko luchaza igalelo lobume bendawo, indalo, okwasekuhlaleni nemitha eyenziwa kukwakhiwa kunye nokuqhuba iziko eliceliweyo endaweni eceliweyo.

2.1.2 Indawo yoPhehlo lwaMandla eNyukliya i-Barakah (INdawo engazanga yasetyenziselwa uPhuhliso ngaphambili)

E-United Arab Emirates (UAE), iGunya loManyano lokuLawulwa ngokuseMthethweni kweNyukliya [Federal Authority for Nuclear Regulation (FANR)] lilawula ukukhethwa kweendawo kunye nokulungiswa kwendawo ukwenzela imisebenzi yenyukliya. UMthetho woManyaano lwe-UAE ngokoXwebhu oluseMthethweni iNombolo 6 ku- 2009 lunika igunya i-FANR ukulawula “Icandelo leNyukliya”. Inqaku (25) lichaza ukukhethwa kwendawo, ukulungiswa kwayo kunye nokwakhiwa kweziko lenyukliya njengemisebenzi elawulwayo apho ilayisenisi ifunekayo esuka kwi- FANR.

Imithetho ye-FANR yokubeka indawo iquka:

- FANR Reg-01: Iinkqubo zoLawulo zaMaziko eNyukliya;
- FANR Reg-02: Ukubekwa kwaMaziko eNyukliya.

Yakuba indawo leyo ihloliwe, lowo uza kwenza inkqubo ufuna ilayisenisi yokuqhubela phambili ukuze alungiselele indawo ekhethiweyo. Yakuba ilayisenisi ikhutshelwe lowo uqhuba inkqubo, umlawuli uza kubona ukulungiswa kwendawo.

NgoFebruwari 2010, kukhutshwe ilayisenisi yokhetho lwendawo yi- Federal Authority for Nuclear Regulation (FANR) isiya kwi-Emirates Nuclear Energy Corporation (ENEC). Le layisenisi igunyazise i-ENEC ukukhetha indawo. Ilayisenisi yokhetholwendawo igunyazise le misebenzi ilandelayo:

- Uphononongo lwengingqi kunye nokubonwa kweendawo ekungenzeka zibe zilungile;
- Ukuhlolwa kwendawo ekungenzeka zibe zilungile kunye nokubonwa kweendawo ezingathi zizigqatse;
- Ukuhlolwa kweendawo ezizigqatsileyo ukuze zihlelwe ngokupheleleyo, iimeko ezikhethekileyo zendawo ezibhekiselele kukhuselo nokhuseleko lweziko lwenyukliya.

Inkqubo yokhetho ithe yenziwa ngokuhambelana neezona ndlela namanqanaba agqibeleleyo asuka kwi- FANR, i-EPRI, i-USNRC kwakunye ne-IAEA.

Indawo ye-Barakah, ekwindawo yase-Barakah kwingingqi yase-Al Dhafra e-Abu Dhabi, malunnga neekhilimitha ezi-5, entshona yamazazantsi-ntshona esixeko i-Ruwais, yakhethwa njengendawo yophehlo lwamandla enyukliya yokuqala ye-UAE (NPP) ilandela uphononongo olupheleleyo olwathatha iinyanga ezili- 12 yaye lwaquka ukuhlolwa kweendawo ngeendawo kwi-UAE yonke, lo gama kuqwalaselwa ezi zinto zilandelayo:

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- Imbali yokubakho kwenyikima;
- Umgama ukusuka kumbindi weendawo ezinabantu;
- Ukusondela kwiindawo ezinkulu ezinikezela ngamanzi;
- Ukusondela kwiindawo ebezihleli zikhona zombane;
- Ukusondela kwizakhiwo;
- Iimeko ezilungileyo zokwakha, ukhuseleko kunye neendlela zokuphuma;
- Ukuqwalaselwa kokungqongileyo.

Ukulandela inkqubo yokhetho, izifundo zeempawu zendawo, zeendawo ezimbini ezikwizinga eliphezulu, nto leyo yenziwayo kule yase-Barakah. Imisebenzi iquke le ilandelayo:

- **Uphando ngeendawo**: Inkqubo yokubhola umhlaba ukusuka elunxwemeni inike ubugcisa bobume bomhlaba kunye neenkcukacha zobume bamanzi asemhlabeni ukuze kubonwe yaye kuncitshiswe ubungozi emhlabeni, lo gama inkqubo zokubhola umhlaba zangaphandle konxweme zinike amanyathelo kwizifundo zemixube yomhlaba kunye nobugcisa bomhlaba, uphando lwemitha yaselwandle kunye nokufunyenwe kwiinkqubo zeelebhu ngokwe-USNRC, Regulatory Guide 1.138.
- **Ukuqokolelwa kweenkcukacha**: Ukuhlola kakuhle iminatha yonxibelelwano kwaye kuqhutyekwa namanyathelo (ngenyanga), kuthathwa iisampuli zokujonga umgangatho wamanzi water (asemhlabeni nawaselwandle), intlenga kunye nesampuli yomhlaba, isiseko esomeleleyo sasemanzini kunye nnophando lweziseko ezomeleleyo zasemhlabeni (ngokwamaxesha onyaka).
- **Isifundo sobume bomhlaba kunye nobume babantu**: Ukuchaza indawo kunye nemida yendawo, indawo ezibekelwe bucala kuloo ndawo, ukwahlulwa kwabantu kwiikhilomitha ezingama 80 endawo, kuquka uqikelelo lwexesha lokusebenza kwelayisenisi.
- **Amaziko akufutshane oshishino, uthutho kunye nawomkhosi**: Ukuchazwa kobume bamaziko afanelekileyo akwiikhilomitha ezi- 8 zendawo, ukuchazwa kwezinto ekungenzeka zibe yingozi, ezigciniweyo okanye ezithuthwayo kunye nokuhlolwa kweengozi ezingenzeka kuloo maziko kuquka uthutho.
- **Izifundo ngemozulu**: Ukuchazwa kweemeko zezulu zengingqi, ekuhlaleni kunye nokuqokelelwe kweenkcukacha zakuloo ndawo, okwenziwe kwimasti yesixhobo esineenkcukacha kubude beemitha ezili 10 nama-20.
- **Ubunjineli bezifundo zamanzi:** UUkuchazwa kwamanzi asekuhlaleni kunye nasemhlabeni, kuquka iimeko eziqhelekileyo nezingaqhelekanga kakhulu, izifundo ezibanzi zemihlaba, kuquka ukufakwa kwamanzi angaphezu komhlaba neenkqubo zokuhlola amanzi asemhlabeni, ukuqokelelwa kweenkcukacha neemodeli, uphononongo lweempuphuma ngaselunxwemeni (oko kukuthi, ii-tsunami, izaqhiwithi, imimoya); igalelo lemibane yomoya; nokuhlolwa phononongo lokukhula kwamaza kunye nokusasazeka kwezinto ezihambelana nemitha ngaphezu komhlaba nakumanzi asemhlabeni. Iziphumo

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zolu phononongo zinike iinkcukacha zeengozi kunye noqikelelo njengezinto ezinegalelo ukuveza indawo ekhuselekileyo neyongiweyo nenyusa umgangatho wendawo.

- **Isifundo somhlaba, iinyikima kunye nobugcisa kwezomhlaba**: Kuqhutywe uphando ukuze kuchazwe ukuma komhlaba kwaye kwenziwa uhlolo olubanzi lweemeko zenyikima, kuquka iingozi ezingenziwa ziinyikima (PSHA), nto leyo ingaba negalelo kuyilo lwesiseko kunye nezakhiwo. Inkqubo ebanzi yomsebenzi wendawo (ukubhola umhlaba, uvavanyo lwemixube yomhlaba kunye nokuvavanywa kwiilebhu) Kanye nophononongo lwaye lwafuneka ukuze oku kuxhase ukubekwa kweziko lophehlo kunye nezinye izakhiwo ezihambelana nokhuseleko.
- **Iqhinga lokuhlolwa kokungqongileyo/ uhlolo lwegalelo lokungqogileyo (EIA)**: izifundo zeelwandle ziye zaqhutywa (oko kukuthi ukuphuma nokujikeleziswa kakhona kwezinto ezimanzi nobushushu) yaye zagqitywa ngokubhekiselele kwiimfuno zokulungiselela ze-USNRC, UAE, ne-EIA. Izifundo esisisiseko ezigqityiweyo zoko kungqonge umhlaba ziye zagqitywa, kuquka uphando lwamaxesha onyaka.

Wonke umsebenzi wagqitywa ngokubhekiselele kwinkqubo yokuqinisekisa ukuhambelana nokusemgangathweni ngokwe- 10 CFR 50, A Isihlomelo B, kunye ne-noMbutho i--American Society of Mechanical Engineers (ASME) NQA-1-1994.

Ukulandela uhlolo kwakhona lwe- FANR lokufakwe kwi- ENEC ukuxhasa ilayisenisi yokulungiswa kwendawo yokwakha indawo yeziko lenyukliya, i-FANR kunye ne-arhente yokungqongileyo ye-Abu Dhabi (EAD), zikhuphe ilayisenisi yokulungisa indawo kwi- ENEC ngo-July ku-2010. Le layisenisi ivumele i- ENEC ukuba iqale ukufaka izakhiwo kuloo ndawo, ezingayelelananga ngqo nezinto zenyukliya, njengemigaqo, ubuxkakaxhaka bokuxhumana ngomnxeba kunye nezakhiwo zolawulo lwendawo. Emva kokukhutshwa kwale layisenisi, i-FANR yenze uhlolo lonke lwemisebenzi yokulungiselela indawo.

3 IINKCUKACHA ZALOWO UFAKA ISICELO

Amagama apheleleyo alowo ufaka isicelo	Eskom Holdings SOC Limited
Idilesi yendawo yokuhlala	Megawatt Park Maxwell Drive Sunninghill 2157
Inombolo yobhaliso yeenkampani	2002/015527/30
Umhla wokudityaniswa	2002
Idilesi ebhalisiweyo	P.O. Box 1091, Johannesburg, 2000
Idilesi ekucelwa ukufakwa kuyo inyukliya	Indawo iseMpuma-Koloni phakathi kweedolophu i-Humansdorp (iikhilomitha ezi- 17,3 emantla), kunye ne-St. Francis Bay (iikhilomitha ezili- 12 km empuma) kunye ne- Oyster Bay (iikhilomitha ezi 4 entshona),yavalelwa ngamazantsi olwandle i-Indian Ocean, umbindi wendawo unezi ndawo zilandelayo

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	X (m): –27522,999806; Y (m): –3784463; Ukusuka ezantsi ukuya phezulu: 34°10'60″ S; Ubude: 24°43'00″ E. Kuba kungekho ndawo yakuhlala, kusetyenziswe i-GPS.
Iinkcukacha zayo nayiphi indawo okanye iinkampani ezisondelele kule ndawo	I-Eskom Holdings SOC Limited yekarhulumente ngokupheleleyo.
Iinkcukacha zayo nayiphi na indlela yongenelelo lwangaphandle okanye ulawulo lokufakwa kwenyukliya ngurhulumente wangaphandle/iinkampani	N/A

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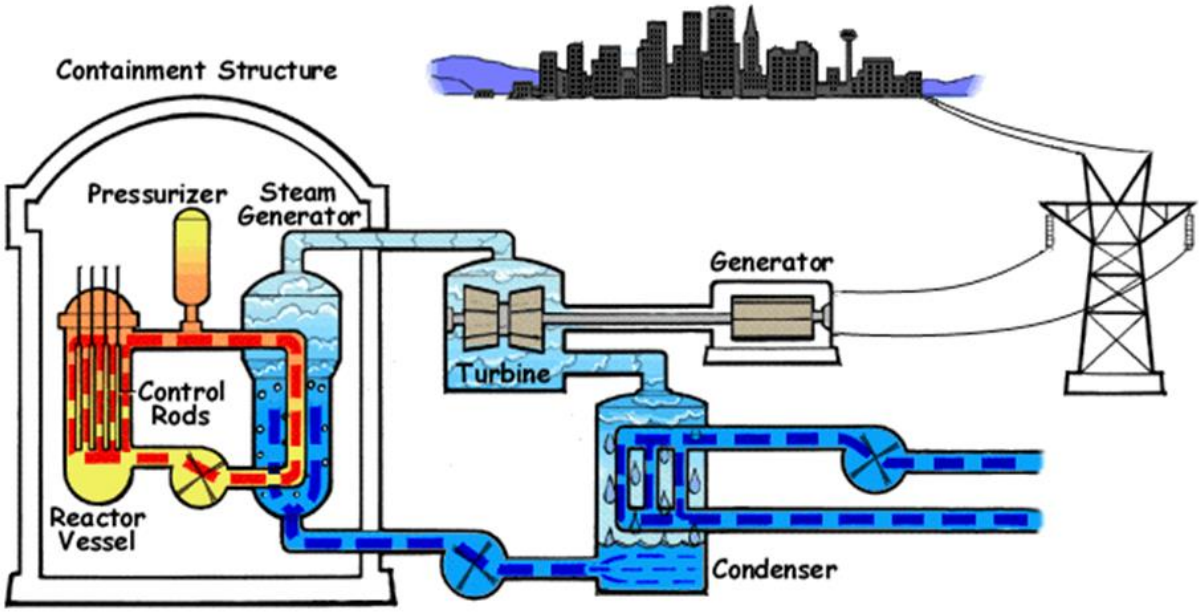
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4 INKCAZELO NGEPROJEKTHI

4.1 INDAWO YOPHEHLO ECELIWEYO

U-Eskom akakasenzi isigqibo kuyilo olukhetheleyo lwezinto eziyelele okanye ezikwindawo yase-Thyspunt, nangona kunjalo ubugcisa be-pressurised water reactor (PWR) (jonga Umfanekiso 1) ukhethwe ngu- Eskom njengohlobo ekufanele lusetyenziswe. I- PWR isebenzisa amanzi alulanjengesipholisi nento yokwenzaizinto zibe phakathi. U-Eskom usebenzise olu hlobo mitha yamanzi ngokukhuselekileyo ngaphezu kweminyaka engama 35 e-Koeberg Nuclear Power Station (KNPS) yaye ke uqhelene nobu bugcisa. Ubugcisa be-PWR obabusetyenziswa e- KNPS babusekwe kuyilo lwe-Westinghouse yase- USA yaye lwakhiwe ngu-Framatome,inkampani ya\ma-French.



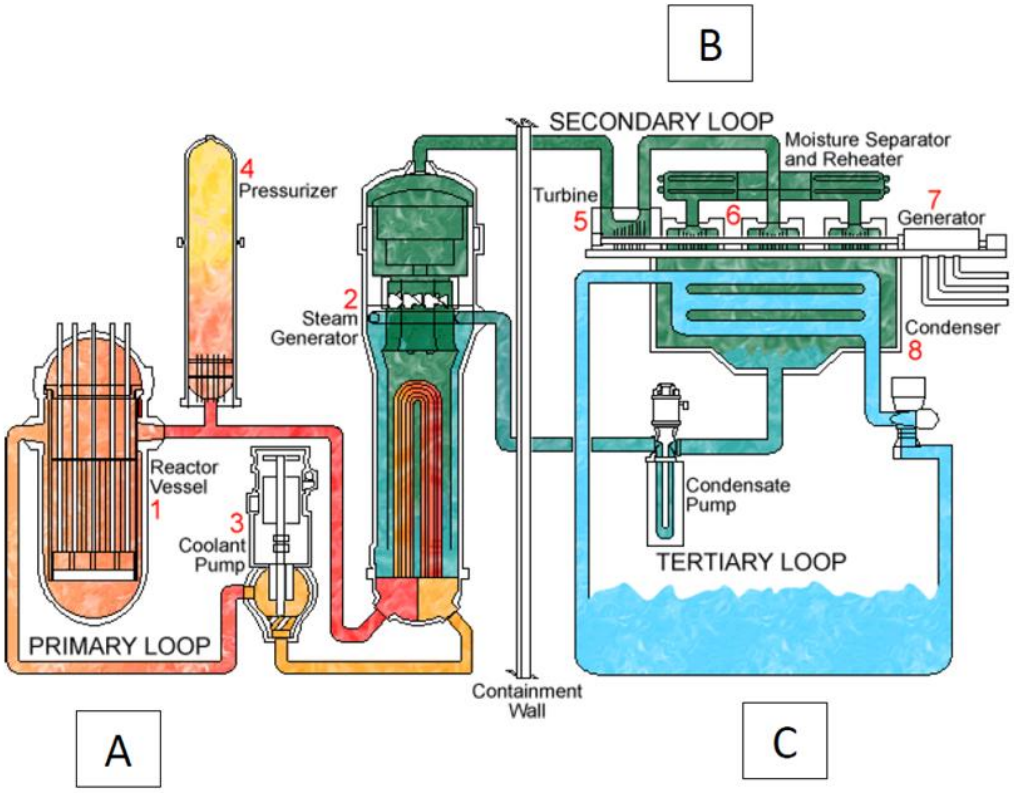
Umfanekiso 1:Isicwangcis esiqhelekileyo se-pressurised water reactor

I-PWR eqhelekileyo yenziwe ngenkqubo emasolontya mathathu apho iinkqubo zahlulwa enye kwenye njengoko kuboniswe kuMfanekiso 2, onokona kuxutywa kuphantsi kuphakathi kwamanzi eenkqubo ezingaphesheya.

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Umfanekiso 2: Ukuqwalaselwa kweenkqubo ze-PWR

Iyunithi nganye yesixhobo sokuphendula sidibanisa isiqithi senyukliya, isiqithi somoya, ukungena kwamanzi kunye neendawo zokuphuma kwakunye, kwezinye iimeko, inqaba yokupholisa. Ezona ndawo zesiqithi senyukliya zezi:

- Isakhiwo se-reactor building (RB), esikwabizwa ngendawo yokugcina into enobungozi, sigcina esi sixhobo kunye namasolontya anoxinxelelo lokupholisa kwakunye nendawo yamasolokontya neenkqubo ezifunekayo ukuze esi sixhobo siphendulayo sisebenze kwaye kukhuseleke. Luxinzelelo oluluqilima ekungaphuma amachaphaza, lubambe isakhiwo esikwagcine imitha ekhululwa embindini, kwimeko engaqhelekanga yengozi yaye lukhusela inkqubo yokuphendula kwesixhobo kwiimeko zangaphandle. Ngexesha lenkqubo eqhelekileyo i- RB igcinwa phantsi koxinzelelo olungahambisani noko.
- Isakhiwo samafutha [fuel building (FB)], esigcina amaziko okugcina izinto, kunye nokugcina amafutha amatsha (ilinde umthwalo wayo osuka kwisixhobo esiphendulayo), kunye namafutha asebenzileyo (aphuma ngaphandle kwesixhobo eso). Isakhiwo samafutha kwakhona sinesixhobo sokupholisa iqula lamafutha kunye nenkqubo yokucoca [fuel pool cooling and purification system (FPCPS)] kwaye, kwiiyunithi ezisebenzayo, isixhobo senkqubo yokuphehla umsi [steam generator emergency feedwater system (EFWS)],
- I-safeguard auxiliary building (SAB) inamagumbi ezixhobo zombane. Ezi zahlulwe zaba ziitreyini ezine (izahlulo), kuxhomekeke kubugcisa, inye inothotho lweenkqubo zongxamiseko yaye itreyini nganye yahlulwe ngokwendawo nomsebenzi.

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- Amagumbi ezixhobo zombane anazo zonke iindlela zokulawula iyunithi (igumbi lokulawula kunye neenkqubo zokwenza, unikezelo lwamandla ombane kunye nezixhobo kwakunye nenkqubo yolawulo [I&C]).
- Isakhiwo sokuncedisa senyukliya (NAB) kwakhelwe kuso iinkqubo zokuncedisa ezifunekayo kwinkqubo yesixhobo esiphendulayo esiqhelekileyo. Esi sakhiwo sinesixhobo senkqubo yemixube kunye nokulawula isandi. [chemical and volume control system (CVCS)], inkqubo egraya inkunkuma iyenze umoya, inkqubo yokupholisa kunye nenkqubo ye=boron yokujikelezisa izinto ukuze ziphinde zisebenze;
- Izakhiwo ezime ngokwahlukeneyo ezibini, sisinye sinesixhobo esivelisa idizili (unikezelo lwamandla kwimeko yongxamiseko).

U-Eskom ugqibe ekubeni akhethe umniki-nkonzo wokwakha isakhiwo senyukliya yaye iinkcazelo ezineenkcukacha ezibanzi zendawo yophehlo eceliweyo azikabikho. Nangona kunjalo, iimpawu ezibalulekileyo zoyilo angathi u-Eskom azifune ukuze azinikezele xa ethathe isigqibo sokwakha inyukliya entsha zezi:

- Uyilo olumiselwe umgangatho lohlobo lwesityalo ukukhawulezisa ukulayisenisa, ukunciphisa iindleko zemali efakwayo kwanexesha lokwakha;
- Uyilo olulula nolomeleleyo, olwenza iziko lophehlo mandla lusebenze kakuhle yaye lubesemngciphekweni ophantsi kwiimeko zenkqubo ezingaqhelekanga;
- Ubomi benkqubo obude nobusoloko busebenza kakhulu kunemitha yenkqubo ekhona – ukwedlula iminyaka engama 60 umzekelo;
- Ukuncipha kokuba kwenzeke iingozi zokunyibilika kwezinto ezingundoqo;
- Ukulunga kwezinto eziquletheyo ngokwezinga eliphezulu;
- Ukuchaphazeleka kokungqongileyo okukwizinga eliphantsi;
- Ukutsha kakhulu ukuze kulungiselela ukusebenza kwamafutha kwanokunciphisa inkunkuma kunye noku
- Izinto zokufunxa ezitshayo ukuze zandise inkqubo yokujikeleza yamafutha.

Ezi mpawu zibonisa ubugcisa be- PWR (ezikwaziwa njengoyilo lwe-Generation 3 kunye no-3+).

4.2 UYILO LWE-GENERATION 3 / 3+ PWR

Izixhobo ze-Generation 3 and 3+ zisebenzise amava eshishini kula mashumi eminyaka alishumi egqithileyo yaye iindlela zempucuko ezininzi zifakiwe kuyilo lwabo. Olu yilo ludibanisa ubugcisa bemafutha, lunendlela elungileyo nephezulu yobushushu, iinkqubo ezihambela phambili zokhuselo (kuquka ukhuselo lwenyukliya njee) yaye kukho uyilo olusemgangathweni lokulungiswa okuphantsi. Zonke iintlobo zezixhobo zombane ezifikelela kwezi mfuno zingasentla ziyaqwalaselwa xa kuthe kwanikezelwa ukufakwa kwenyukliya kwixesha elizayo. Uhlobo loyilo u-Generation 3 no-3+ luqondwa ngoku njengolusemalikeni, luquka(kodwa lungaphelelanga) kwi-Westinghouse AP1000, Korean APR1400, Framatome’s EPR kunye ne-Rosatom’s VVER1000.

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Umahluko ongundoqo kwezi zityalo kunye ne-Koeberg Nuclear Power Station zinikwe kwiTeybhile kunye nenkcaza emfutshane yobugcisa ngabunye bunikwe ngasezantsi.

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ITheybhile 1: Ukuthelekiswa kweeMpawu ezinguNdoqo zoYilo oLwaziwayo lwasePWR

Uphawu	**Koeberg (Isalathiso)**	**AP 1000**	**APR1400**	**EPR**	**VVER1200**
Umphuhlisi	I-Framatome	I-Westinghouse/ Mitsubishi	I-Dosam (KHNP)	I-Framatome	I-Rosatom (ASE)
Amandla obushushu obungondoqo (MWth)	2 775	3 400	3 983	4 250	3 200
Amandla obushushu be-NSS (MWth)	2 790	3 415	4 000	4 500	3 212
Imveliso eseleyo yamandla ombane (MWe)	900	1 117	1 400	1 600 – 1 700	1 082
Ukusebenza okulungileyo kwesityalo (%)	32	35,6	35	37	34.5
Uyilo lobomi besityalo (iminyaka)	40	60	60	60	60
Iziporo	3	2 imilenze eshushu/4 imilenze ebandayo	4	4	4
Uluhlu lwepini yokudibana kwamafutha	17x17	17x17 isikwere	16x16 isikwere	17x17 isikwere	Ezinamacala amathandathu
Inani leendwo ekudibana amafutha kwindawo nganye engundoqo.	157	157	241	241	163
Umda wokutyebisa (%)	4,95	4,80	3,80	5 or MOX	4,69

Uphawu	**Koeberg (Isalathiso)**	**AP 1000**	**APR1400**	**EPR**	**VVER1200**
Inani leendawo zokuphehla umoya kwisixhobo ngasinye sombane	3	2 zinendawo engunxantathu	2 zinendawo engunxantathu	3 zinendawo engunxantathu	4 ukuma kwepaseji
Ukuma kweziphehli zomoya	Eme nkqo	Eme nkqo	Eme nkqo	Eme nkqo	Horizontal
Impompo yombane yokupholisa	3	4	4	4	4

4.2.1 AP1000

I-AP1000 yi-PWR enamandla neyenziwe nangakumbi ukuyilwa yi-Westinghouse Electric Company. Luhlobo olukhulu loyilo lwe-AP600 olwaphinda lwajongwa lwaza lwaqinisekiswa yi- US NRC ngo-2005 ngoyilo lokuqala AP1000 olwaqala iinkqubo e-China kwiSitishi saMandla eNyukliya i--Sanmen ngo- 2018.

Yindawo yophehlo lwamandla oluneziporo ezibini elinenkqubo yesixhobo sombaneesipholisayo (RCS) olunesekethe zokuhambisa umbaneezimbini, inye inesivelisi somophu, iimpompo ezipholisayo ezinezixhobo zombane ezibini, ezifakwe ngqo kwisivelisi somophu, loo nto isusa ukufakwa kwamaphayiphi phakathi kweem[pompo ezifakwe ngqo kwisivelisi somophu, umlenze omnye otshisayo kunye nemilenze emibini ebandayo ukujikelezisa ukupholisa kwesixhobo sombane. Isakhiwo esenziwe lula sokuxhasa iinkqubo ezisisiseko sinciphisa uhlolo lwangaphakathi yaye luphucula ukufikeleleka ukuze kulungiswe.

I- AP1000 inenjongo yokunciphisa iingozi kakhulu yokuqinisekisa ukuqhubeka kusetyenzwa yindawo yokugcina xa kukngabakho ingozi engakhokhelela ekwehlisweni kwezinga lesakhiwo sombindi wesixhobo sombane eso. Kufikelelwa kwimisebenzi yokhuselo lwesixhobo eso siphendulayo sombane kusetyenziswa iinkqubo nje kuphela, akukho mpompo zisebenzayo, akukho lujikelezo olulolunye lombane (AC)amandla, amanzi apholisayo, HVAC (umoya ongenayo nophumayo oshushu kunye nokuphephezeliswa komoya) kunye nezixhobo nolawulo (I&C).

Iimpawu zoyilo ezikhethekileyo zifakiwe ukuze kugcinwe yaye kuzinziswe umbindi ongaphakathi kwakunye nokunciphisa igalelo lokungqongileyo elingaphazamisana namandla okumelana nokuqhekeka kwemveliso. Ezi mpawu zoyilo zinika ukuncitshiswa okwahlukahlukeneyo nokungafunekiyo kwezinto ezimelana neemeko ezingaqhelekanga zengozi embi. Ezi mpawu ziquka inkqubo yokwehlisa uxinzelelo ezenzekelayo yesixhobo sokupholisa sombane (ADS), ukukwazi ukuzalisa leyo ndawo ivulekileyo, izinto ezilayitwa yi-hydrogen kwindawo ekunqandwa intlekele kuyo izinto kunye nenkqubo yokupholisa indawo yentlekele (PCCS). Ezi mpawu zoyilo zisebenza ukugcina i-RCS ilungile, zinqande ukwanda kwengozi ngenxa yoxinzelelo oluphezulu olusuka ekutsheni kwe-hydrogen okanye ukutsha kwento ngesaquphe kunye nokususa ubushushu kwindawo yengozi. Ezi mpawo zokunciphisa zigcina izinga eliphantsi lokukhutshwa kwemveliso ye-fission ukusuka kwi- AP1000 enobungozi.

I-AP1000 iyilelwe ukuqwalasela okusingqongileyo njengento yokuqala. Ukhuseleko lwabasebenzi boluntu, nabasebenzi beziko lophehlo lwamandla kunye negalelo kokungqongileyo kujongwe ngolu hlobo lulandelayo:

- Ukukhutshwa kweenkqubo kuncitshiswe ziimpawu zoyilo.
- Iinjongo ezimbi zokubekwa kwabasebenzi kwimitha emibi kulungisiwe yaye kwnelisa.
- Ubungakanani bonke bemitha engalunganga buncitshisiwe.
- Ezinye izinto ziyinkunkuma enobungozi (ezingeyomitha) zincitshisiwe.

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4.2.2 APR1400

I-Advanced Power Reactor 1400 (APR1400) sisixhobo sombane esisemgangathweni senesamanzi alula esenziwa ngabase-Korea ngo- 2002. Uyilo lusekwe kumava afunyenwe ngenxa yophuhliso, ukwakha kunye nenkqubo ye-OPR1000, Optimum Power Reactor 1000 MWe, isixhobo sokuqala sombane esisemngangathweni e-Korea. I-APR1400 ineempawu ezikumgangatho ophezulu ezifana nongenelo ngqo nolusuka kwinkqubo yokhuselo yeveseli, isixhobo esilawula ukuhamba njee kombane kwiitaki engena umbane wokhuseleko, kwinkqubo yogcino lonikezelo lwamanzi okuphinda kwenziwe amafutha, inkqubo ephambili ngokomgangatho yokwehlisa uxinzelelo kukhuseleko kunye neenkqubo zokunciphisa nokulawula iingozi ezimbi. Olunye uyilo lokuphucula yindlu yolawulo engundoqo ophuma phambili, oyilwe kuqwalaselwe ubunjineli beempawu zabantu, luneenkqubo luneenkcukacha eziphele leyo ze-I I&C.

4.2.3 I-European Pressurised Reactor (EPR)

I-EPR yi-PWR eyayilwa yi- Framatome kunye EDF (France) kunye ne- Siemens (Germany) neyathi yaqala ukusebenza ngeyunithi ye-EPR eyagunyaziswa e-China (Taishan 1) ngo- 2018.

Sisixhobo sophehlo lwamandla oluneziporo ezine. Isiporo ngasinye senziwe ngesivelisi somophu kunye ne-RCP, zonke zidityaniswe kwisixhobo sombane eso. Le nkqubo yonke yokuqala inesixinzeleli esinye kuphela ezidityaniswe kumlenze oshushu wesixhobo sombane njengoko kuboniswe kuMfannekiso 3.

Uyilo lokhuseleko lwe-EPR safety lusekwe okokuqala kuphononongo lokuqonda oluphelleliswa luphononongo lokuhanjiswa kombane. Inkqubo yokuqonda isekwe kwingqiqo enzulu yokhuselo, edibanisa amanqanaba amane, anjongo zawo zizezi:

- Ukubuyekeza xa kunokufelisha abantu okanye isixhobo;
- Ukugcina ukusebenza kakuhle kwemiqobo yokuthintela umonakalo wendawo yophehlo kwakunye nakwimiqobo ngokwayo;
- Ukukhusela uluntu kunye nokungqongileyo kumonzakalo xa kungenzeka le miqobo ingasebenzi kakuhle.

Ngako koko, xa kujongwe koku, eyona nto iphezulu ekufuneka kuqalwe ngayo yomgaqo-nkqubo kukunqanda iingozi, yaye ukuba oku kuyafelisha, ukunqanda iziphumo ezingenzeka futhi kunqandwe nakuphi na ukudaleka kwemeko engaba mbi ngakumbi. Isebenzisa iinkqubo zokhuseleko (ezifana namandla e- AC) ukukhusela isixhobo sophehlo eso.

Indawana yonke yokukhupha enkulu [large release fraction (LRF)] yezinto ezinemitha ye-athom, ekhutshwa ukuya kokungqongileyo isuka embindini womonakalo izakuba ncinane kune-10^{-6}/wonyaka wesixhobo. Ezinye zeempawu ezizezona zibalulekileyo ze-EPR njengoko kuboniswe kuMfanekiso 4.

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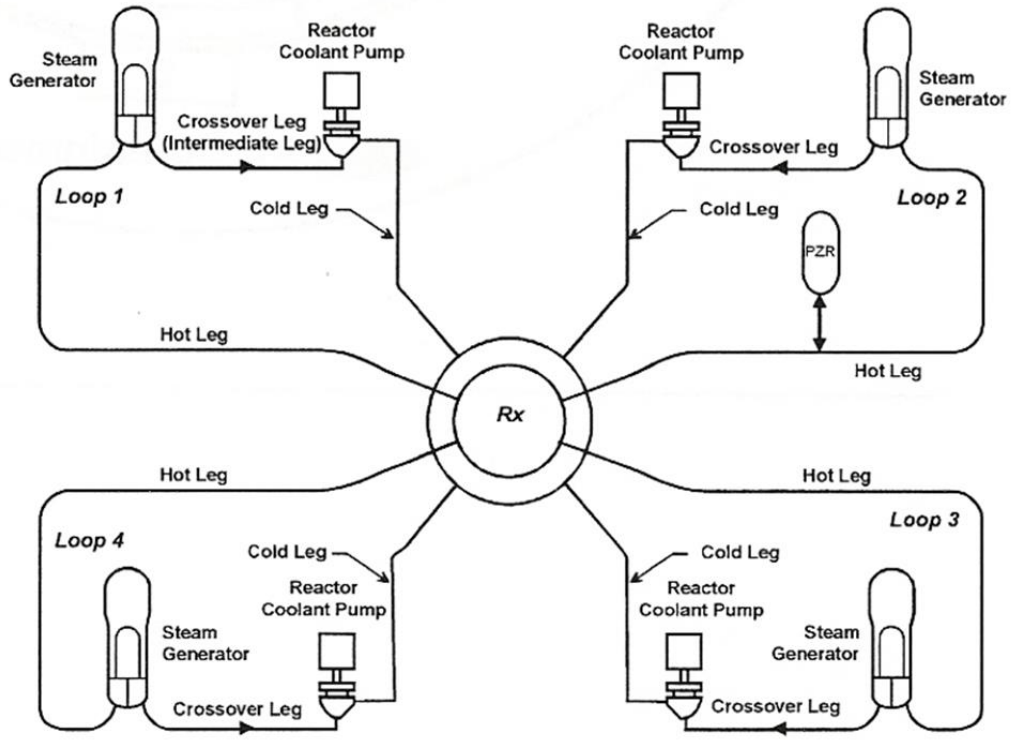
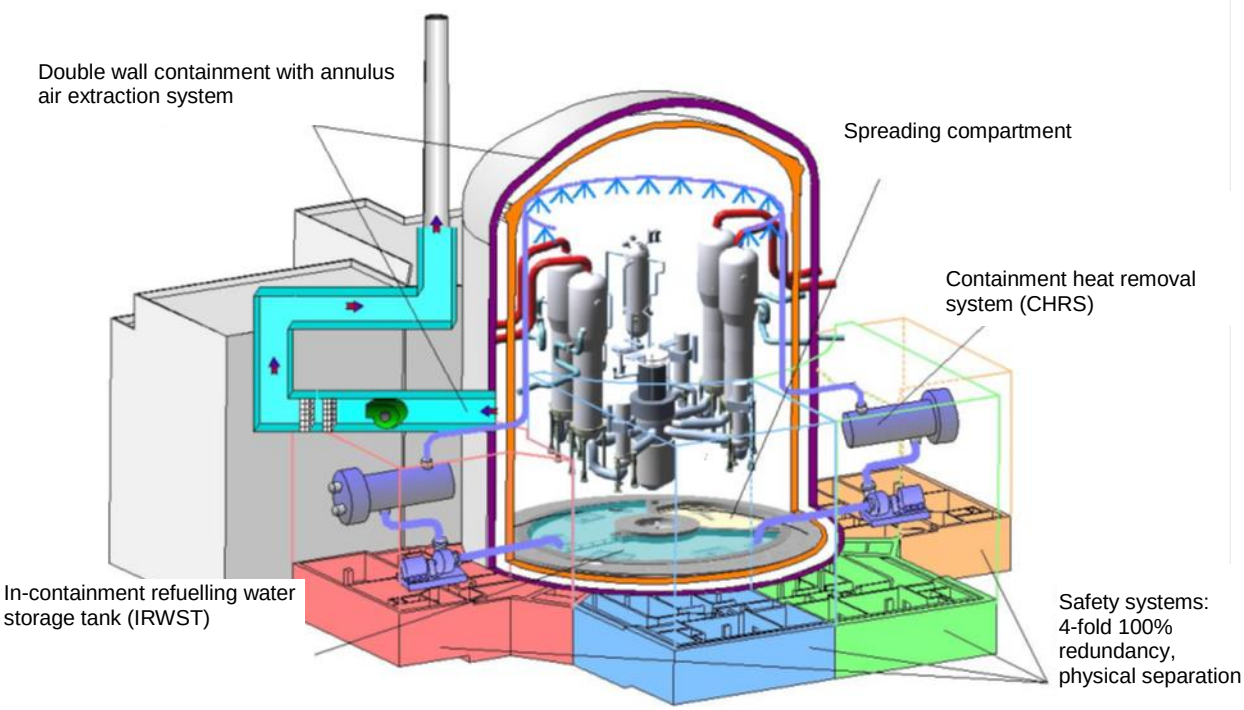


Figure 3: Illustration of generic arrangement of SSCs in a four-loop nuclear plant



Umfanekiso 4: Ezona mpawu zokhuseleko lwe- EPR PR

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4.2.4 VVER1200

I-VVER-1200 (AES-2006) luyilo lwesixhobo sophehlo lwamandla eNyukliya lwase-Russia olumiselwe umgangatho, olwanelisa iimpawu zoyilo lwe-Generation 3+ yaye luzama ukufikelela kukhuseleko lwangoku neempawu zokuthembeka, lulungiselela iindleko zokwakha. U- VVER umele ukuba yeya 'sisixhobo samandla samanzi-kumanzi' (oko kukuthi isixhobo sombane esipholiswa ngamanzi nesamandla athothiswa ngamanzi). Ii-VVER zifakwa kakhulu e-Russia kodwa nase-China, Finland, Germany, Slovakia, Bulgaria, India kunye nase- Iran.

Ezona mpawu yahluka ngazo i-VVER xa ithelekiswa kwezinye ii-PWR:

- Izivelisi zomophu ezibutyaba-
- Iindawo ezidibanisa amafutha ezinamacala amathandathu
- Akukho ngenelo luvela ngasezantsi kwisikhongozeli soxinzelelo
- Izifaki xinzelelo ezinamandla kakhulu ezinika indawo enkulu yesixhobo sokupholisa.

Amanzi akwisekethe zokuqala agcinwa phantsi koxinzelelo olumana luphakanyiswa ukunqanda ukuba angabili. Nanjengokuba amanzi ethatha bonke ubushushu obusuka embindini futhi ayakhanyisa, kufuneka isekethe ibe ilungile.

Ukunika ukuphola okuqhubekayo kombindi wesixhobo ngeemeko zongxamiseko, ukupholiswa kokuqala kuyilwa ukuba kube yinto engasafunekiyo.

4.3 UKUPHEHLWA KOMBANE KWIINDAWO ZOPHEHLO LWAMANDLA ENYUKLIYA

4.3.1 Ukudityaniswa kwee-athom zenyukliya.

Amandla enyukliya axhomekeke kwi-uranuim etyetyiswe kancinci yaye/i-oxide exutyiweyo (MOX) njengesiseko samafutha sokuvelisa ubushushu. Ubushushu obenziwe ngexesha leziphumo zokusebenza kwenyukliya kwinkqubo ebizwa nge- 'fission'. I-fission iquka ukohlulwa kwe-nyukleyi yee-athom entails the splitting of nuclei of atoms by smaller particles, called neutrons. Xa i-*fissile atomic nucleus* enkulu ibethwe yi-*nucleus,* iyaqhekeka ibe zi-*nuclei* ezincinci ezimbini okanye ngaphezulu ize ikhuphe amasuntswana kunye ne-*ionising photons*. Emva koko ezinye nyutroni zizihambelayo ziye zenze enye i-*fission* ize le nkqubo ye-*fission* iqhubeleke ingayeki. Ukuqhekezwa, kwahlulwe ii-athom kunye ne-eneji eyenziwa koku kubizwa ngokuba yi-*nuclear fission.*

Le nkqubo yenzeka ngaphakathi kwisiphehli-nyukliya (i-reactor) aze amandla ombane aphumayo enze shushu amanzi ngokugqithisileyo. Ukuthintela ukuba iqondo lobushushu lingenyuki lide ligqithe kumlinganiselo wesiphehli-nyukliya, amanzi okupholisa aye atyhutyhe kwaba matshini benqanaba lokuqala lokuphehla ngeenjongo zokugcina iqondo lobushushu likulo mlinganiselo ufunekayo. Amanzi ashushu aphuma ashushu aphuma ngombhobho wamanzi oshushu wesiphehli-nyukliya angene kumatshini womphunga (i-SG) aze aphume kwi-SG ngombhobho we-SG wokugqithisela kwisivalo sempompo yokupholisa yesiphehli-nyukliya (i-RCP) aze aphinde

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agalelwe kwisiphehli-nyukliya ehamba ngombhobho wokupholisa wesiphehli-nyukliya. Kwimeko apho icandelo lesiphehli-nyukliya linesixhotyana sokumpompa ngamandla njengoko kunjalo kwicandelo 2 loMfanekiso 3, amanzi ashushu aphuma kwisiphehli-nyukliya ehamba ngombhobho wamanzi ashushu agqithe kwisixhotyana sokumpompa ngamandla angene kwi-SG, aze aphume kwi-SG ehamba ngombhombho wokugqithisela we-SG. Ukusuka apho, la manzi abuyiselwa kwisiphehli-nyukliya yi-RCP ehamba ngombhobho wamanzi abandayo, apho athi aphinde afudunyezwe ngamandla ombane avela kwinkqubo yokuphehla inyukliya.

Ngethuba kusenzeka oku, ubushushu buphuma koomatshini benqanaba lokuqala lokuphehla baye kwaba benqanaba lesibini, kuze kwaba benqanaba lesibini amanzi abiliswe ngokuthe chatha ngolo hlobo atshintshe abe ngumphunga. Lo mphunga ibe nguwo ojikelezisa injini yomphunga yona ize idumise umatshini wokwenza umbane othi wona uvelise umbane.

Amaxesha amaninzi ubuxhakaxhaka be-PWR busebenzisa amanzi ahlukileyo kwinqanaba ngalinye lokuphehla inyukliya. Injongo yokuba kusetyenziswa amanzi ahlukileyo kwinqanaba ngalinye kukuqinisekisa ukuba amanzi aphuma kwinqanaba lokuqala, asele enemitha enobungozi kwaye ekwimibhobho evalekileyo, akuvuzeli koomatshini benqanaba lesibini, ke ngoko angangcolisi amanzi akwaba matshini. I-KNPS inobuxhaka-xhaka boomatshini abahlulwe kathathu (umatshini wenqanaba lokuqala lokuphehla, owelesibini nalo welokugqibela). Umatshini wenqanaba lokuqala uhlala uphantsi koxinzelelo sisivalo sokumpompa ngamandla yiyo le nto kusithiwa sisiphehli-nyukliya esimpontshwa amanzi ngamandla.

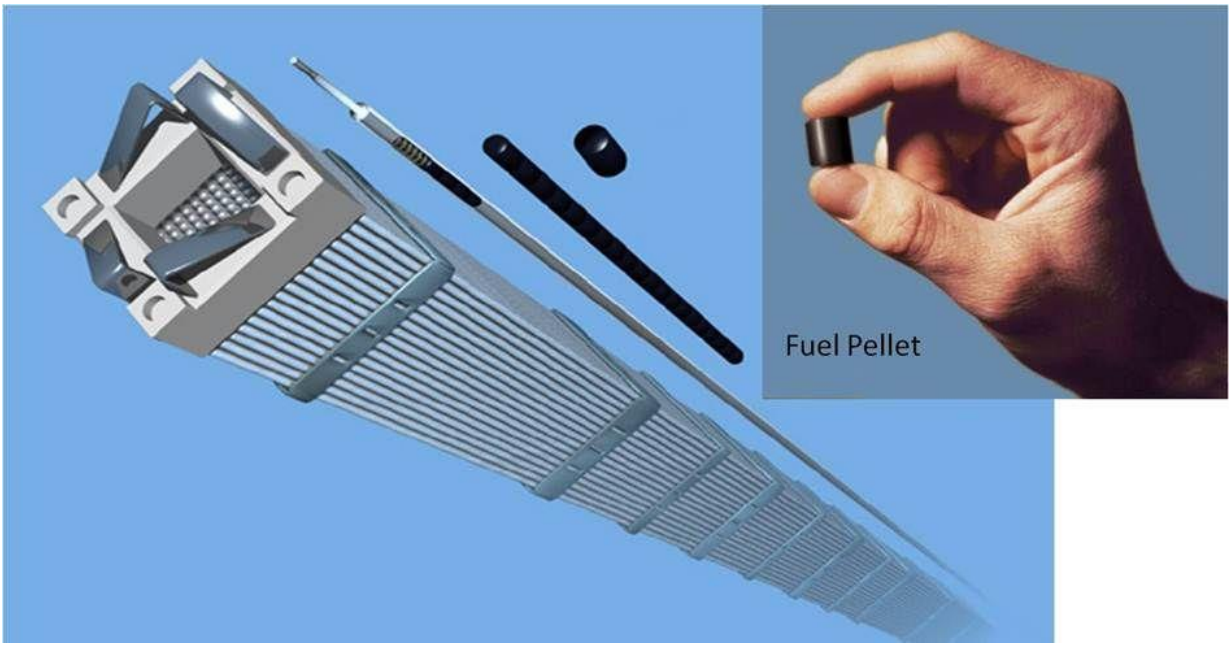
4.3.2 Amandla anemitha enobungozi aza kusetyenziswa

Isiphehli-nyukliya sivelisa size sinkinkishe amandla ombane ngokusebenzisa inkqubo yokuqhekeza ii-athom nge-*Uranium-235* (i-U-235) ezimbumbulwana ze-*uranium oxide* (UO_2), njengamafutha esiphehli-nyukliya. Amakhulu avisayo amatankana amancinci okugcina amafutha esiphehli-nyukliya anamawaka eembumbulwana ezenziwe ngesiramikhi zesibaso se-*uranium oxide* ngawo anguyena ndoqo wesiphehli-nyukliya. Phakathi kwisiphehli-nyukliya kukho amacetyana e-U235 avelisa ubushushu obuninzi ubusuku nemini. Amaxa amaninzi iimbumbulwana ze-UO_2 zihlohlwa kwimibhojana zize zenze iintongana zesibaso, ezithi zifakwe kwisiphehli-nyukliya njengamatankana okugcina amafutha okanye isibaso. Kufuneka kukho i-*neutron* (iqhele ukuba yi-*beryllium* exutywe ne-*polonium*, i-*radium* okanye enye i-*alpha-emitter*) ukuze iqalise inkqubo yokuphehla amafutha amatsha kwisiphehli-nyukliya esitsha; noko kunjalo, ukudumisa isiphehli-nyukliya ebesicinyiwe usebenzisa isibaso ebesele sisebenzile kungangafuni ukuba kude kubekho ii-*neutron* ezintsha njengoko kuza kuba kusekho ii-*neutron* ezaneleyo zokufudumeza isiphehli-nyukliya. Xa kuphehlwa inyukliya, ii-*neutron* ezininzi zikhutshwa ngoko nangoko, kodwa ezinye zona ziye zishiyekele, ziphume kancinci. Ezi zishiyekile zibalulekile ukwenza isiphehli-nyukliya silawuleke sikwazi ukugcinwa sikwiqondo elithile elifunekayo. Kusetyenziswa amanzi amaxesha amaninzi ukuqinisekisa ukuba ii-*neutron* aziphumi ngokuphokoka ngolo hlobo zivelise inyukliya eninzi ngokugqithisileyo, ngelithuba iintsinjana zokubamba isantya kunye ne-*boron* enyibilikileyo kumatshini wokuqala wokupholisa zisetyenziselwa ukulawula isantya ekuphehlwa ngaso kwisiphehli-nyukliya.

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UMfanekiso 5: Umzobo womzekelo womatshini osisigcini-sibaso we-PWR, onentsinjana yesibaso, intsinjana yokulawula kunye nembumbulwana yesibaso ekumfanekiso yawo wodwa. (kumfanekiswana omncinci: ifoto yembumbulwana yesibaso engekasebenzi)

Uhlobo lweziphehli-nyukliya ezinokufumaneka eThyspunt zakhiwe ngendlela eza kukwazi ukumelana nophehlo oluqhuba lungemi oluvelisa inyukliya eyenziwe nge-*uranium,* ekoomatshini bokugcina isibaso senyukliya abenzelwe kanye lo msebenzi.

Umzekelo, oomatshini abazizigcini-sibaso ababizwa ngokuba yi-AP1000 bayafana nezinye izibaso ze-PWR ezifana noomatshini abazizigcini-sibaso abomeleleyo omnye obizwa ngokuba yi-17x17 nomnye oyi-17x17 XL ekudala yawenza lo msebenzi. I-AP1000 inesibaso esisebenzayo esinobude obumalunga neemitha eziyi-4.2 kwaye sinentsinjana zesibaso ezingama-264 ezibekelelwe zasisikwere esineentsinjana ezili-17 icala ngalinye (17x17). Ezi ntsinjana zesibaso zine-*uranium*, evuthiswe yaze yatsala yafikelela ku-5 wt% U-235, ezimbumbulwana ezifakwe kumbhobho we-ZIRLO™. Le mibhobho iye ifakwe umbane ize itywinwe ngokutshiselwa kula macala avulekileyo omabini ukuze ikwazi ukugcina isibaso. Ezi ntsinjana zesibaso ziye zivuthelwe ngaphakathi nge-*helium* ngethuba zidityaniswa ukuthintela ukuqhuqheka nokuqhekeka xa zisebenza ngolo hlobo kuthintelwe ukuba umambathiso wazo utyeke. Iintsinjana zesibaso zikwi-AP1000 azixinaniswanga zinezithutyana zegesi ezantsi kweembumbulwana zesibaso, xa zithelekiswa nezinye inyanda zokugcina isibaso zangaphambili, ukuze kukwazi ukuba kuveliswe igesi eninzi ngenxa yokuba kusetyenziswa isibaso esininzi. Iintsinjana zesibaso zikwanazo neentlokwana zokufunxa ezitshisekayo ezizimbumbulwana zesibaso ezigqunywe nge-*boride* okanye eze-*uranium oxide* ezixutywe ne-*gadolimium oxide*, okanye zombini, ukulungisela inkqubo yokuphehlwa kwenyukliya ngaphakathi kwisiphehli-nyukliya.

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Le ndawo isembindini we-AP1000 inombhojana ofana nefimbili wokukhokela osetyenziswa xa kulungiswa umphakathi we-AP1000. Ezinye iindawo ezi zingama-24 zishiyekileyo kwinyanda yokugcina isibaso zinemibhojana yokukhokela, encanyathiselwe kumlomo ongasentla nongezantsi ukuze ukwazi ukubamba isigcini-sibaso. Ii-AP1000 zinezixhotyana zokuxuba umsinga ongahambi ngesantya esiphezulu kwisalatha-moya sokuxuba esiphezulu.

Ngethuba isakhiwa i-AP1000 yafakelwa nobuxhaka-xhaka obunobuchule bodidi oluphezulu, obufana nee-*low pressure drop intermediate grid, intermediate flow mixing grids*, isivalo esingumlomo okhululwayo sakwaWestinghouse, kunye nokukwazi ukugcina isibaso ixesha elide. Isivalo esingumlomo esisemazantsi sesokuhluza ukungcola into leyo enciphisa amathuba okuba isibaso sonakaliswe yintlenge ekukungcola kumbhobho wamanzi abandayo wesiphehli-nyukliya. I-AP1000 inayo nesigqubuthelo esilicangca sokuyikhusela ukwenzela ukuba ikwazi ukumelana nentlenge ekukungcola.

I-EPR apha ngaphakathi iyakwazi ukufuna iintlobo ezahlukeneyo zenyanda yesibaso ezifana ne-AFA 3GL okanye eluhlobo lwe-HTP. I-EPR inobude obusebenzayo obuzimitha eziyi-4,2 kwaye inentsinjana zesibaso ezingama-264 ezibekelelwe zasisikwere esineentsinjana ezili-17 icala ngalinye (17x17). I-EPR ikwafakwe nemibhojana yokukhokela efana nefimbili engama-24 esetyenziswa njengesixhobo sokukhangela isixhotyana sokudibanisa iintsinjana zesibaso, (ii-RCCA) naxa kulungiswa izinto ezithile ngaphakathi.

Iintsinjana zesibaso ze-EPR zenziwe ngecangca le-M5^{TM} elingadliwayo ngumhlwa futhi nelingadumbiyo elenziwe ngomxube weentsimbi ezahlukeneyo. Ezi ntsinjana zineembumbulwana zesiramikhi ze-UO_2 ekuqaleni etsaliswe yafikelela ku-5 wt% U-235 okanye ngaphantsi. Ezi ntsinjana zesibaso zibanjwe zadityaniswa yintsimbi edlala indima ye-asi zaze zagqunywa ngamanye amacangca ngaphandle asibhozo e- M5^{TM} namanye amacangca amabini okuzahlula. Ezi mbumbulwana zine- Gd_2O_3 esisisibaso esiyityhefu esivuthayo esine-Gd engumyinge ophakathi kwe-2 wt% ne-8 wt% ukuthintela ukuba inkqubo yokuphehla ingavelisi inyukliya eninzi ngaphakathi. Inani leentsinjana zesibaso ze-Gd_2O_3 kwisigcini-sibaso lingaphakathi kwesi-8 nama-20 kuxhomekeka kumthamo kwisibaso esiyityhefu ofunekayo ukuze loo matshini usebenze okanye kwizinto ezinxulumene nokhuseleko

Kwezi ntlobo zezigcini-sibaso zikhankanywe apha iqondo lokuveliswa kwamaceba e-athom kunye nezinye ii-elementi ezinee-athom ezininzi liyenyuka xa kusetyenzwa, kangangokuba oku kude kufikelele kwimeko apho isibaso singenakusebenziseka. Yiyo loo nto iingqokelela yezibaso ezisebenzileyo zikhutshwayo kwisiphehli-nyukliya emva kweenyanga ezili-12 ukuya kwezingama-24. Isibaso esisebenzileyo siyaqhubeleka nokukhupha umophu oyingozi noshushu.

Emathunjini esiphehli-nyukliya, ingqokelela yezibaso ezisebenzileyo igalelwa kumatanki esibaso esisebenzileyo ukwenzela ukuba iphole futhi nomophu lo unobungozi uphunguke ude ufikelele kwiqondo elifanelekileyo phambi kokuba sikhutshelwe kwifatyi zesibaso esisebenzileyo. Kwitanki lesibaso esisebenzileyo, la manzi acwenge phezu kwaso athintela ukuba umophu onobungozi ungagqithi aze afunxe nobushushu obukhutshwa sisibaso. Ingqokelela yesibaso esisebenzileyo igcinwa kumatanki esibaso esisebenzileyo iminyaka emininzi ukulungiselela ukuba siphole kodwa oku kuxhomekeka nasekubeni ikhona na indawo kwitanki lesibaso esisebenzileyo.

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4.4 UKUPHUMUMA KWEMITHA ENOBUNGOZI

Ukuphuma kwemitha kuthetha ukusasazeka okanye ukuphuma kwamandla angamaza okanye angamasuntswana esithubeni okanye kwinto ebambekayo. Oku kuquka:

- ukuphuma kwemitha kwisitsalane sombane esifana namaza amanzi, ukukhanya okubonakalayo kunye nee-x-ray;
- ukuphuma kwemitha kumasuntswana e-athom afana ne-*alfa,* i-*beta* ne-*neutron radiation*.

Kukho iintlobo ezimbini zokuphuma kwemitha enobungozi, i-*radiation,* ezikukuphuma kwemitha okutshintsha i-athom ibe yi-ayoni (*ionising radiation*) okanye okungatshintshi athom ibe yi-ayoni (*non-ionising radition*).

4.4.1 I-Ionising Radiation

I-*ionising radiation* luhlobo lokuphuma kwemitha ene-eneji eyaneleyo ukuze kuthi ngethuba idibana ne-athom, ikwazi ukwahlula amasuntswana e-athom abambene nkqi kumzila we-athom, oko kubangele ukuba i-athom ibe nombane okanye ibe yi-ayoni. La masuntswana e-athom asusiweyo ane-eneji yentshukumo (*kinetic energy*) enokujika ezi athom ziphunyelwe yimitha zibe yi-ayoni. Inkqubo yokuphuma kwemitha ethi itshintshe i-athom ibe yi-ayoni (*ionising radiation*) yahlulwe yayiyinkqubo yokuphuma kwemitha ekhupha i-eneji kwindawo enkulu kunye nale ikhupha i-eneji kwindawo ezinzeleyo okanye ukuphuma kwemitha engena itshone kakhulu kunye nokukhutshwa kwemitha engatshoni ide yondele okanye izike.

Iintlobo eziqhelekileyo ze-*ionising radiation* ziquka oku: *α-particles, β-particles*, kunye ne-*γ-rays*. Ezi ntlobo zokuphuma kwemitha zinamasuntswana anombane zizo ngqo ezitshintsha i-athom ibe yi-ayoni; ezinye ezifana nezi: X-, γ kunye nemitha yenyutroni aziyintshintshi ngokwazo ngqo i-athom ibe yi-ayoni. Uphando-nzulu kwicandelo lezenzululwazi nge-X-reyi neminye imitha yezonyango lubonisa ukuba ukuba nee-athom ezininzi ezitshintshayo zibe yi-ayoni zibe nombane kukho okubangela umonakalo kwinyama nezihlunu zomntu.

Iintlobo ezimbini eziphambili ze-*ionising radiation* zezi:

- **I-*alpha (α) radiation*** inamasuntswana amakhulu anombane aphuma kwii-athom ze-elementi ezifana ne-*uranium* kunye ne-*radium*. I-*alpha radiation* inganqadwa ime ngxi liphepha okanye yile nwebu incinci ingaphezulu kwisikhumba sethu. Kodwa ke zona izinto ezine-*alpha* zingena emizimbeni yethu xa siphefumla, sisitya, okanye sisela, futhi zingangena kwizibilini zethu ngaphakathi ngolo hlobo zenze umonakalo kuzo.

- **I-*Beta (β) radiation*** inee-elektroni. Zona zingena zitshone kune-*alpha* kwaye ziyakwazi ukugqitha emanzini ayisentimitha e-1 ukuya kwezi-2 ukutyeba. Kumaxa amaninzi icangca elizimilimitha ezimbalwa ukutyeba lingayinqanda i-*beta radiation*.

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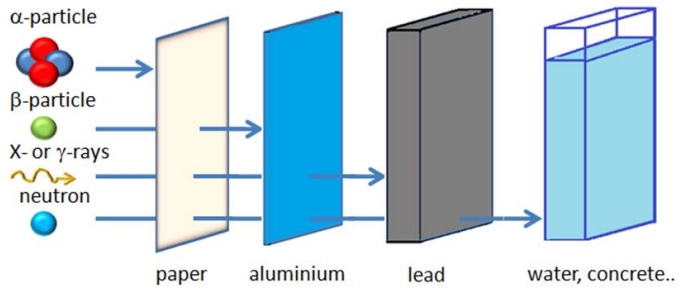
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- **Imitha ye-*gamma*** **(**γ) kukuphuma kwemitha kwisitsalane sombane esifana nee-X-reyi, ukukhanya kunye namaza amade. Imitha ye-*Gamma* iyakwazi ukugqobhoza emzimbeni womntu, kodwa inganqandwa ludonga oluluqilima olwenziwe ngekhonkolo okanye ilothe. Kodwa oku kuxhomekeka kwi-eneji enayo.
- **Inyutroni** ngamasuntswana angenambane kwaye awatshintshi ii-athom ibe yi-ayoni ngokwawo. Kodwa indlela ezisebenzisana ngayo nee-athom zento kungazala i-*alpha, beta, gamma* okanye ii-X-reyi izinto ezo zikwazi ukutshintsha i-athom ibe yi-ayoni. Iinyutroni ziyakwazi ukugqobhoza ke ngoko zinganqandwa kuphela yinduli yekhonkolo, amanzi okanye iparafini eninzi.

Ukuze kuphungulwe ubungozi nomonakalo owenziwa kukuphuma kwemitha eyingozi, kuye kusetyenziswa izinto ezininzi zokugquma kukhuselwa abantu ukuba banganqashwa yimitha, kwaye oku kuxhomekeka kuhlobo lwemitha olufuna ukugqunywa njengoko kuboniswa kuMfanekiso 6.

To reduce the harmful effects of radiation, various shielding materials are used to protect the public from undue radiation exposure, depending on the type of radiation that shielding is required for as shown in UMfanekiso 6: Iintlobo ze-ionising radiation kunye nezinto ezinokuzithentela zingagqobhoizi

.



UMfanekiso 6: Iintlobo ze-ionising radiation kunye nezinto ezinokuzithentela zingagqobhoizi

Ingozi ehamba nokunqashwa yimitha ixhomekeka kwelo hlobo lwemitha, ixesha elithile ukusuka kumhla eyaziswa ngayo kunye nomthamo ochithakeleyo kunye nowemitha engeno kulo nto ichatshazelweyo. Zikhona izifo eziyingozi ezifana nokutsha okanye ukudyunguka esikhumbeni okanye isifo sokunqashwa kakhulu yimitha xa imitha ethe yaphumela ngaphandle ingaphezulu kwiqondo elisikiweyo lemitha efanelekileyo. I-*ionising radiation* encinci ingabangela izifo ezinokuvela emva kwexesha elide ezifana nomhlaza. Umonakalo odumileyo ewenzayo kukwenza umonakalo ngqo kwiiseli (umsonto we-DNA kwi-chromosome), ukutshintsha kwe-*chromosome*, umonakalo kwiiseli zofuzo, izifo ezifuzwayo, ukungasebenzi kwamalungu omzimba, umhlaza, futhi kwiimeko ezinzinzi, ukufa.

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4.4.2 I-*Non-Ionising Radiation*

Kwelinye icala yona i- *non-ionising radiation* inamaza ombane ne-eneji kamazibuthe ahamba kunye esithubeni. Amaza amade (*radio wave*) kunye namaza amafutshane (*microwave*) akhutshwa zi-eriyali zokusasaza alolunye uhlobo lwe-eneji yomazibuthe wombane. Amaxesha amaninzi amabinzana afana no-*electromagnetic field* okanye u-*radiofrequence field* ayasetyenziswa ukuchaza ukuba ikhona i-eneji yomazibuthe wombane (i-RF). I-*non-ionising radiation* ithetha ukuba le mitha ikhutshwayo ayina-eneji yaneleyo ukuze ikhuphe ii-elekroni kwii-athom ize ibangele umonakalo kwimpilo (efana nomonakalo kwiiseli zofuzo (i-DNA) obangwa yi-*ionising radition* ofana nalo ukhutshwa yimitha ye-*gamma* kunye neenyutroni.

4.4.3 Ukunqashwa koluntu yimitha enobungozi

Imitha enobungozi ihlala ikhona emhlabeni. Abantu banqashwa yimitha enobungozi yendalo ephuma kwizinto ezininzi (eziquka izinto ezifumaneka emhlabeni, emanzini, kunye nasemoyeni) kunye nezenziwa ngabantu yonke imihla. Enye into evelisa imitha enobungozi abadibana nayo abantu iquka imitha enobungozi yendalo esuka kwinzonzobila yamajuku-juku, ingakumbi phezulu esibhaka-bhakeni, umzekelo xa umntu ekhwele inqwelo-moya eya kumazwe aphesheya ephaphela phezulu kakhulu, umzekelo, i-*Boeing 747* ibhabha isuka eLondon isiya eTokyo, umyinge wemitha enobungozi phezulu kangaka umalunga ne-5 *microSieverts* (µSv)/h.

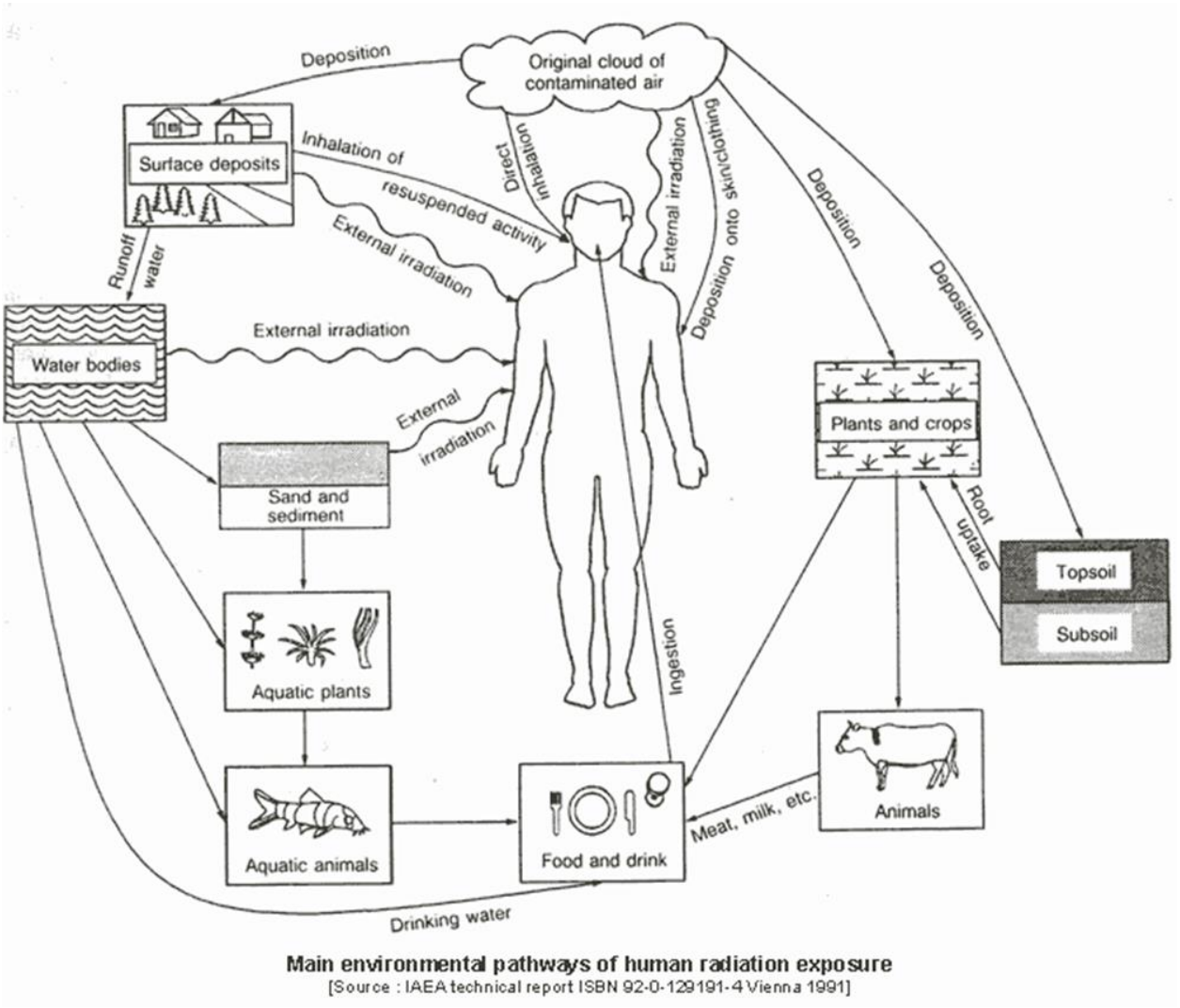
Izinto ezivelisa imitha enobungozi kakhulu bokunqasha uluntu ngokubanzi zezo zizezendalo kunye nezo zenziwe ngabantu. Izinto zendalo ezivelisa imitha enobungozi, ezifana ne-*radon,* eyigesi yendalo exhaphake kakhulu, nephuma kuhlobo lwamatye athile nasemhlabeni. Abantu banganqashwa yimitha enobungozi emininzi ukuba bahlala kwiindawo ezinamatye okanye iintlobo zomhlaba ezivelisa i-*radon*. Phakathi kwezinye zezinto ezivelisa imitha enobungozi ezenziwa ngabantu, eyona ntsusa yemitha inobungozi kukusetyenziswa kwale mitha inobungozi kunyango kwihlabathi liphela.

Imitha enobungozi ingenzeka emzimbeni ngaphakathi okanye esiqwini ngaphandle, kwaye le mitha inobungozi umntu angadibana nayo ngeendlela ezahlukeneyo, umz., ukuyiphefumla, ukuyiginya, okanye ngokuba imbethe ngqo (jonga kuMfanekiso 7). Ukuchatshazelwa yimitha enobungozi ngaphakathi emzimbeni kwenzeka xa i-*radionuclide* ithi yabizelwa ngomphefumlo, yatyiwa okanye umntu watofwa ngayo ize ikuchazaphezele esiqwini ngaphandle xa uthe wagutyungelwa lilifu elinemitha enobungozi ehamba emoyeni.

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UMfanekiso 5: Iindlela zokudibana nemitha enobungozi

Ukuchatshazelwa yimitha enobungozi kwahlulwe ngokochatshazelwa yile mitha emsebenzini (abasebenzi abasebenza kwindawo enemitha enobungozi), ukuchatshazelwa ngenxa yonyango (abantu abagulayo abanyangwa ngokuthi kusetyenziswa uhlobo oluthile lwale mitha inobungozi), kunye nokuchatshazelwa koluntu (ukuchatshazelwa koluntu ngokubanzi ngenxa yokuba lukwindawo okanye kufutshane nezinto ezivelisa le mitha inobungozi ekunokwenzeka ukuba ezo zinto zezendalo okanye zenziwe ngabantu). Ukunqashwa yimitha enobungozi ephuma kwizinto zendalo kuquka ukuba kwiindawo enezinto ezininzi zendalo ezivelisa le mitha inobungozi ngenxa yeentlobo zomhlaba okanye amatye athile afumaneka kwezo ndawo kunye nezinye izinto ezenziwe ngabantu ezifana nengozi enxulumene nenyukliya.

Zintathu iimeko abantu abanokuthi bazibone bejongene nengxaki yokunqashwa yimitha enobungozi, ezo zezi: imeko ebicetywe kwangaphambili, imeko yezinto ezinale mitha ezihleli zikho kunye nokuzibona ujongene nale ngxaki ngenxa yempazamo ibingacetywanga:

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- **Imeko ibicetywe kwangaphambili** yenzeka xa le mitha inobungozi ivulelwe okanye isetyenziswa ngabom kulungiselelwa ukuzalisekisa okuthile (umz., xa le mitha isetyenziselwa unyango).
- **Imeko esusela kwizinto ebezihleli zikho** yimeko apho le nto ivelisa le mitha ibikade ikho kakade ngethuba kuthathwa isigqibo sokuba kuthathwe amanyathelo. Iimeko ezinje ngezi ziquka ezo zendawo enezinto ezininzi ezivelisa le mitha inobungozi.
- **Ukuzibona ukule ngxaki ngenxa yempazamo ibingakhe icetywe** kubhekisa kwiimeko apho le mitha inobungozi inokufumaneka kwimeko ibicetyiwe, okanye kwinto yenkohlakalo eyenziwe ngabom, kuye kengoku kunyanzeleka ukuba kuthathwe amanyathelo akhawulezileyo.

Ingozi yokuba uluntu luzibone lusengxakini yokunqashwa yile mitha inobungozi ngenxa yokuba ithe yakhutshwa yangena kokusingqongileyo inqandwa kukuqaliswa kwenkqubo yokukhusela ukusasazeka kwemitha enobungozi, i-*system radiation protection* (i-RP), kunye nobuxhaka-xhaka bokugquma amaziko okuphehla inyukliya okanye kumashishini avelisa le mitha inobungozi. Le nkqubo inika imigqaliselo eyaneleyo nefanelekileyo yokuthintela umonakalo onokwenziwa yi-*ionizing radiation* ebantwini nakwezinye izidalwa ezingengobantu (izityalo nezilwanyana). Ebantwini, i-RP isetyenziselwa ukuthintela umonakalo ombi, kwimeko ezininzi, onokuthinteleka nokuphungula amathuba okuhlaselwa ngumhlaza kunye nezinye izifo ezifuzwayo kangangoko inako. Kwindalo okanye kokusingqongileyo, i-RP isetyenziselwa ukuqiniseka umonakalo owenziwa yile mitha mncinci kakhulu ukuze kuhlale kukho iintlobo zezityalo nezilwanyana ezahlukenyo, ukulondolozwa kwezidalwa kunye nendalo, uluntu kunye nezityalo nezilwanyana zihlala zikwimeko entle nencumisayo. Umthamo wale mitha iyingozi ubalwa ngokujonga umyinge wale mitha inobungozi okhutshwa yinto nganye eyivelisayo.

Kuluntu ngokubanzi oluchatshazelwe yile mitha, umthamo wale mitha awubalwa ngokuthi kujongwe kumntu ngamnye indlela achatshazelwe ngayo njengoko kunjalo xa kujongwa kwimeko yabantu abasemisebenzini. Umthamo wonyaka wale mitha enqasha uluntu ngokubanzi uqikelelwa ngokuthi kubalwe imitha enobungozi iyonke ekhutshwe ngexesha elithile kunyaka omnye yaze yanqasha abantu eziqwini kunye nomyinge ovumelekileyo we-*radionuclides* ngalo nyaka. Oku kukhatshwa nalu lwazi oluthathwe kungcoliseko lwemizi-mveliso, nezinto ezahlukeneyo kokusigqongileyo ezichaphazela uluntu, ulwazi ngezinto ezisisiqhelo kunye neendlela zokuphanda

Xa kukukhutshwa imitha enobungozi okucetyiweyo, umthamo uyaqingqwa futhi kubekwa nezithintelo ngomthamo onokuveliswa kulungiselelwa ukukhuselwa koluntu. Kwiimeko apho kunokuba nabantu abanokuchaphazeleka kuye kubekwe nemiqathango ethintela ingozi. Kwiimeko ezingacetywanga nezo zihleli zikho kakade, icebo lokubeka nokuqingqa umlinganiselo wento leyo ivelisa imitha enobungozi kusetyenziswa lona kwizidalwa ezingengobantu, owona mthamo mkhulu unokuveliswa kusetyenziswa wona ukubala ubungozi obunokwenzeka kwindalo.

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Umlinganiselo obekiweyo kwiindawo ezinoluntu wemitha enobungozi kwiimeko ezicetyiweyo yi-1 mSv ngonyaka. I-NNR icacisa ukuba umlinganiselo ongekho ngaphezulu kwe-250 µSv ngonyaka kuninzi lwabantu abazakuchaphazeleka kakhulu (ababizwa ngokuba ngabantu abangumzekelo omele iqela).

Kwimeko nganye ecetyiweyo, kulindeleke ukuba umlinganiselo oza kuchaphazela uluntu nendalo uphononongwe kuthathelwe ingqalelo zonke ezinye indlela le mitha inobungozi enokuvela ngazo. Uphando olwenziwayo ukuqwalasela umonakalo owenziwe yimitha enobungozi kuluntu luthathela ingqalelo nezinto ezilulwelo ezingena elwandle, ukusasazeka elwandle (ukutyiwa kokutya kwaselwandle, ukuphefumla umfafazo waselwandle), ukuzika iye phantsi kolwandle (imitha enobungozi yangaphandle), kunye nemitha ephuma ihambe emoyeni kuqukwa nokusasazeka (imitha enobungozi yangaphandle, ukuphefumla umophu/isisi) kunye nokushiyeka kwentlenga (imitha enobungozi yangaphandle, ukulenga-lenga, kunye nokutya kwasemhlabeni) njengoko kubonisiwe kuMfanekiso 7. Umonakalo owenziwa yimitha enobungozi kuluntu nakwindalo uhlolwa ukulungiselela iimeko zikaxakeka ukuze kwenziwe amalungiselelo afanelekileyo ukukhusela uluntu nendalo.

Njengenxalenye yemisebenzi yalo yesiqhelo, iziko lokuphehla inyukliya ligalela ulwelo negesi kwindalo/kokusingqongileyo lilandela imigaqo ecacileyo nephantsi kweliso ukuqinisekisa ukuba uluntu alibekwa mngciphekweni mkhulu ngokungekho mfuneko. Olu lwelo kunye negesi kufuneka zingadluli kumlinganiselo obekwe ngokweMiyinge enokuKhutshwa eVumelekileyo ngoNyaka (i-AADQ), yona elandela imigaqo ebeka owona mlinganiselo mninzi uvumelekileyo ngonyaka oyi-µSv/a (into ebizwa nanjengomlinganiselo omiselweyo) kumntu oyinxalenye yabo baza kuchaphazeleka kakhulu kwiqela labantu abakwindawo esemzileni wemitha enobungozi njengoko kucacisiwe kwi-NNR ngokwamasolotya oMthetho weQumrhu leSizwe eliLawula iNyukliya, uNombl 47 ka-1999 (i-NNRA). Ngaphambi kokuba kukhonjwe le ndawo icetywayo yokwakha isiphehli-nyukliya eThyspunt, kuza kuqhutywa uhlolo oluqwalasela imiba yezokhuseleko ukubonisa ukuba zonke izinto ezinxulumene nokhuseleko zithathelwe ingqalelo ngethuba kuyilwa iziko lokuphehla inyukliya, nesiqinisekiso sokuba imiqobo ekhoyo yokuthintela ukuphuma kwezinto ezinemitha enobungozi iza kuthintela ukuphuma kwale mitha ngendlela engalawulekiyo into leyo inokuthi ikhokelele ekubeni uluntu nokusingqongileyo zichatshazelwe yimitha enobungozi.

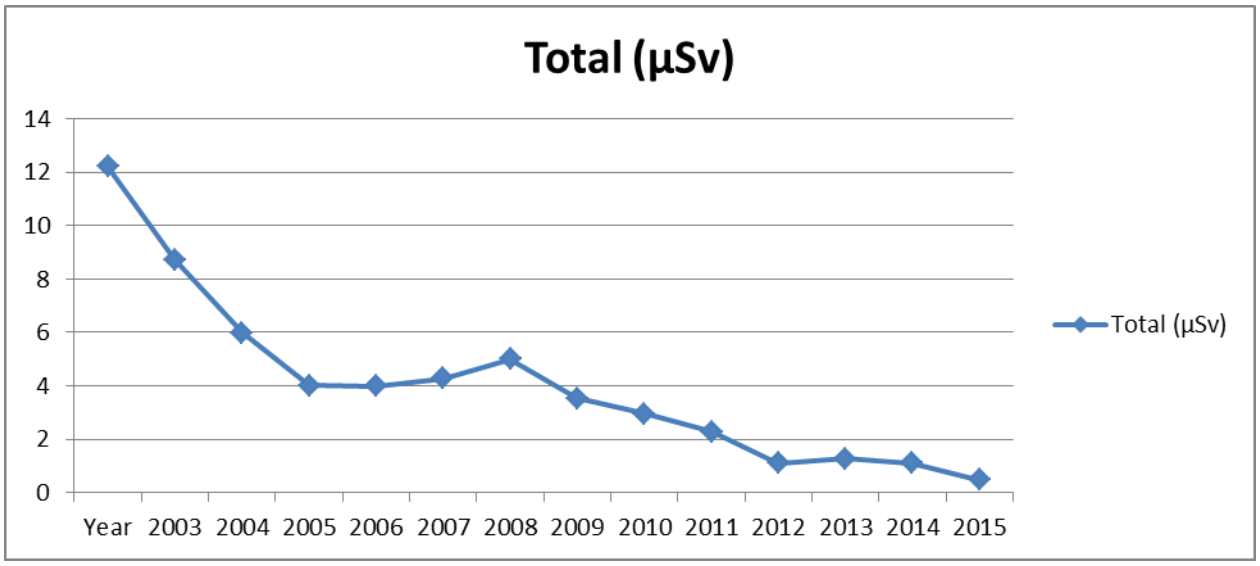
Ngonyaka ka-2014, umthamo wemitha enobungozi ephuma e-KNPS echaphazele abantu ungaphantsi kulo mlinganiselo ubekiweyo we-250 µSv/a (jonga kuMfanekiso 8).

Kulindeleke ukuba naliphi na iziko lesiphehli-nyukliya elifunwa ngu-Eskom alizikukhupha umthamo wemitha enobungozi ongaphezulu kumlinganiselo obekiweyo oyi-250 µSv/a.

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UMfanekiso 6: Umyinge wemitha enobungozi ephumileyo eKoeberg

4.4.4 Imitha enobungozi Emsebenzini

Abasebenzi abaqeshwe ngu-Eskom ukuba basebenze ngemitha enobungozi benziwe uhlolo noxilongo olunzulu lwezonyango ukujonga ukuba imizimba nempilo yabo iza kukwazi na ukumelana nokusebenza kwindawo enemitha enobungozi. Phambi kokuba abasebenzi basebenze kwindawo enemitha enobungozi baye bafumane uqeqesho baze banikwe nesiqinisekiso sokuba bangasebenza ngemitha enobungozi. Oku kunceda umsebenzi ngamnye abuqonde ubungozi obuhamba nokusebenza kwindawo enemitha enobungozi eminizi kwakunye namanyathelo akhoyo okubakhusela. Abasebenzi abasebenza ngemitha enobungozi banikwa isixhotyana esibizwa ngokuba yi-*electronic personal dosimeter* (EPD) eboniswe kuMfanekiso 9 kunye ne-*thermo-luminescent detector* (TLD) eboniswe kuMfanekiso 10 ezihamba nabo ngalo lonke ixesha besemsebenzini ukujonga umthamo wemitha enobungozi ekhoyo emoyeni besebenza kwiindawo ezingangeni wonke umntu.



UMFanekiso 7: Ii-Electronic personal dosimeters

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UMfanekiso 8: I-Thermo-luminescent dosimeter

Abasebenzi abasebenza ngemitha enobungozi abasebenza kwiindawo ezingangeni wonke umntu (iindawo ezinemitha enobungozi emininzi kakhulu), banikwa neempahla zokubakhusela ezikumgangatho ohambelana nokhuseleko ngokomthamo wemitha enobungozi ekhoyo.

Ukuphungula ubungozi obunokwenziwa yimitha enobungozi xa ubani esebenza ngezinto ezikhupha imitha enobungozi kubalwa ixesha, umgama kunye nesikhuseli. Oku kungacaciswa ngolu hlobo:

- Ukuba umntu uchitha ixesha elininzi ekwindawo enemitha enobungozi engqongqo, unamathuba amaninzi okuba le mitha ichaphazele impilo yakhe.
- Ukuba mfutshane umgama phakathi kwento ephuma imitha enobungozi kunye nomntu oyisebenzisayo, maninzi amathuba okuba le mitha yenze imonakalo kuye.
- Ukuba singqindilili ngokwaneleyo isikhuseli asisebenzisayo umntu xa esebenza ngemitha enobungozi, unamathuba amahle okukhuseleka anganqashwa yimitha enobungozi

Umyinge ovumelekileyo wemitha enobungozi emsebenzini kwiimeko ezicetyiweyo, yi-20 mSv ngonyaka othi ubalwe ngesithuba seminyaka emi-5 (i-100 mSv ngeminyaka emi-5), kukho nomgqaliselo wokuba umthamo ungadluli ku-50 mSv ngonyaka omnye.

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5 OKUQWALASELWAYO XA KUSAKHIWA IZIKO LESIPHEHLI-NYUKLIYA

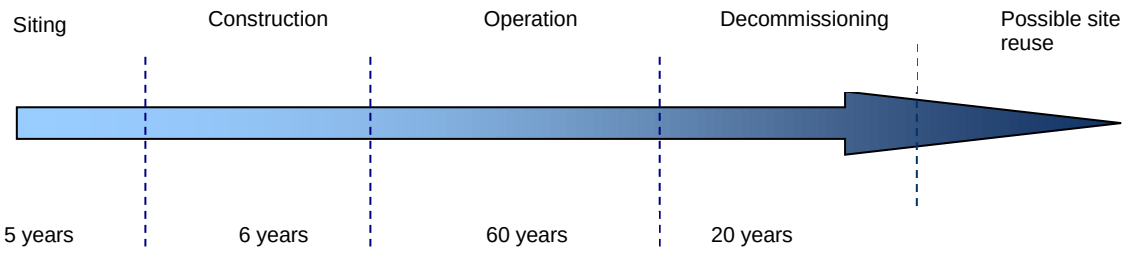
5.1 AMANQANABA OKWAKHIWA KWESIPHEHLI-NYUKLIYA

Iziko lokwakhiwa kwesiphehli-nyukliya lakhiwa ngamanqanaba ahlukeneyo ngokwemigaqo ye-*NNR Position Paper 0009* (PP-0009) (jonga kwiTheyibhile 2).

ITheyibhile 2: Amanqanaba e-NNR okukhutshwa kwelayisenisi

Inqanaba	Umsebenzi	Isigunyaziso senyukliya
1(a)	Ukusekwa kwesiza	Iphepha-mvume
1(b)	Imisebenzi yokuqala yesiza	NISL / NIL ukuya kwisiza
1(c)	Imisebenzi yokuqala yokwakha	NIL ukuya kwisza kusetyenziswa i-Licence Change Request (LCR)
2(a)	Isicwangciso somzobo wokwakha (asinyanzelekanga)	Isigunyaziso sokuqalisa umzobo wesakhiwo/Ukuqinisekiswa komzobo wesakhiwo
2(b)	Ukuvelisa (Izinto ezithatha ixesha elide ukwenziwa)	Isigunyaziso sokuvelisa
3(a)	Ukwakha	NIL yokwakha iZiko lokuPhela iNyukliya LCR
3(b)	Amafutha aya kwisiza ekwakhiwa kuso	NIL via LCR
3(c)	Ukulayishwa kwamafutha nokusetyenziswa kwayo	NIL via LCR
4	Ukusebenza kweziko	NIL via LCR
5	Ukucoca nokuvala iziko	NIL via LCR

UMfanekiso 11 Ubonisa amanqanaba nexesha eliqikelelwayo lenqanaba ngalinye iziko lesiphehli-nyukliya lisebenza.



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UMfanekiso 9: Amanqanaba Aqikelelwayo Okwakha nokuSebenza kwesiPhehli-nyukliya

Amaziko ophehlo-nyukliya amaninzi akhoyo ngoku akhutshelwa ilayisenisi kwiminyaka engama-40 eyadlulayo. Eli ziko lesiphehli-nyukliya afuna ukulakha u-Eskom liza kuhlala iminyaka engama-60 enokuthi yandiswe ide ifikelele kwengama-80. Inani kunye nohlobo eziza kwakhiwa ngazo iziphehli-nyukliya eziza kwakhiwa akukagqitywa ngazo, kodwa ziza kuba luhlobo lwe-*Pressuriser Water Reactor*.

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5.2 IMIQOBO ETHINTELA ULWAKHIWO

Sele ukhethiwe waze wakhonjwa umhlaba oza kubiyelwa ekuza kwakhiwa ngaphakathi kuyo (uboniswe kuMfanekiso 13) kodwa into ekungekagqitywa ngayo emva kokuba kusetyenziswe ezi nkcukacha zikhoyo ngeempawu zesiza kunye nemizobo yesakhiwo sesiphehli-nyukliya. Le yindawo ekuza kwakhiwa kuyo isiphehli-nyukliya kunye nezinye izakhiwo. Njengoko kungekabikho qumrhu likhethiweyo zisengumbono nje wokuhlahla indlela ezi nkcukacha zikhoyo zomzobo wesakhiwo kunye nesiza kunye neminye imilinganiselo emininzi yeli ziko lokuphehla inyukliya.

Nangona kunjalo, zikhona iinkcukacha ezikhoyo ke ngoko lungenziwa uqikelelo futhi zibikwe neengxaki ekulindelekileyo ukuba kungadityanwa nazo xa kuqaliswa umsebenzi wokwakha kwesi siza kunye nemigaqo eza kulandelwa xa kuqaliswa umusebenzi wokwakha kwesi siza. Iinkcukacha ezizeleyo zoku zinikiwe kula macandelo alandelayo. Kodwa kufuneka abantu bakhumbule ukuba ezinye izinto zingatshintsha ngenxa yotshintsho olunokwenzeka kwiinkcukacha ezikhoyo ngesi siza, utshintsho kwimithetho elawula okanye kwindlela izinto ezenziwa ngayo kwihlabathi.

5.2.1 Imiba eqwalaselwayo yezokusingqongileyo

Inkqubo ye-Nuclear-1 EIA ayikaqukunjelwa. Ngokweziphumo zophando oluqhutywe zingcali kunye nezeendibano zokufakana imilomo noluntu, iingxaki zezokusingqongileyo esele ziboniwe ziza kuthathelwa ingqalelo ngokwesiCwangciso sokuLondoloza okusiNgqongileyo sona esisekelwe kwimigqaliselo yoMthetho weSizwe wokuLondoloza okusiNgqongileyo.

5.2.2 Imiqobo yezinto ezibambekayo

Le miqobo ikwisakhiwo ilandelayo kufuneka ithathelwe ingqalelo xa kuzotywa amathala (ithambeka elisisinyuko) eziko lokuphehla inyukliya.

- Amathala aza kuxhasa ii-NPP kufuneka abe kule ndawo ineenduli zesanti ezingaphakamanga. Oku kuza kunceda kwenze ukuba kungagrunjwa isanti eninzi kusombiwa. Naluphi na utshintsho olwenziwe kulo mzobo lungawuchaphazela kakubi kakhulu umsebenzi wokomba isiseko se-NPP.
- Umthamo wesanti namatye aza kugrunjwa, aqokelelwe ndawonye, kuphinde kuditywe ngawo aza agqekezwe uza kuxhomekeka kwindawo udonga lokuxhasa elwakhiwe kuyo, ubukhulu balo kunye nokuba isiphehli-nyuklisa kufuneka sizike kangakanani na emhlabeni ngokwemizobo yesakhiwo sayo.
- Kwezi ndawo likulo udonga lokuxhasa i-NPP umphezulu wamatye aza kuvela aza kugudleka utyeke ke ngoko kuza kufuneka alungiswe akrwelwe kude kuvele ilitye elingazikuqhezuka kukusindwa sisakhiwo. Lakuba ilitye elomeleleyo livelile,

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kungaqaliswa ukwakhiwa umgangatho wokuqala kusetyenziswa isamente yomhlaba ebekwa kuqala xa kweli cala lingaphantsi kwesi siqithana senyukliya, njengoko kwenziwe njalo kwi-KNPS.

- Uphando-nzulu ngenzululwazi yezolwandle oluqhutyiweyo ukuza kuthi ga ngoku lubonisa ukuba elona liza likhulu kufuneka lilungiselelwe xa kusakhiwa leliyi-+13,5 m amsl futhi lenzeka ka-1 emva kweminyaka eyi-1 000 000, oko kukuthi 1:1 000 000. Iliza elingaka ubukhulu lenzeka xa ulwandle lizele futhi kukho neziphango, xa ulwandle lusilwa lunamaza alwatyuzayo, uguqu-guquko lwemozulu kunye ne-*tsunami.* Ukuze esi sakhiwo sikwazi ukumelana neemeko ezifana neze-*tsunami*, kufuneka ii-NPP zibe nalo mlinganiselo: +15 m amsl.
- Indawo akuyo amanzi asemathunjini omhlaba uhambelana nendlela umhlaba lo umi ngayo, anyukela kuhle ngasemntla-ntshona. Iindonga zokuxhasa i-NPP kufuneka zakhiwe ngohlobo lokuba kufuneka kubekho umgama oyi-2,0 m ubuncinane phakathi komphezulu wedonga lokuxhasa kunye nendawo akuyo amanzi aphantsi komhlaba. Lo mgama uphakathi kwamanzi asemathunjini omhlaba uza kubanzulu ngomyinge ongaphezulu kwe-2,0 m kuso sonke siza, ibe lelicala lingasemntla-mpuma kuphela eliza kuba namanzi aphantsi komhlaba akufutshane kwindawo elikuyo idonga lokuxhasa i-NPP.
- Xa udonga lokuxhasa lisiya lisiba lide uza kunyuka nomthamo wamanzi okupholisa ofuna ukugalelwa kwiinjini zokumpompa amanzi. Yiyo le nto kubalulekile ukuqinisekisa udonga lokuxhasa i-NPP liphakame ngokwaneleyo lize likwazi ukumelana nomthamo wombane oza kuveliswa. Kuqikelelwa ukuba umthamo wamanzi abandayo okupholisa ukuba malunga ne-184 m^3/s kwi-4 000 MWe, kuze kwi-2 650 kufuneke i-76 m^3/s, futhi lo ngumthamo oza kusetyenziswa isithuba seminyaka engama-60 elixesha eliza kuhlalwa zi-NPP. Oku kukwathetha nokulahleka komthamo wombane oveliswayo kunye nesixa semali eyinkunzi esingenakuphinda sibuyiswe.

5.3 IMIZOBO YESAKHIWO EKHETHIWEYO YOKWAKHIWA KWESIZA

Le mibono yemizobo iza kucaciswa kweli candelo isengamaqalela aluqulunqo, kwaye iza kuxhomekeka kwimigqaliselo eza kubekwa xa kukhutshwa ilayisenisi kunye neminye imithetho ekuza kufuneka ithotyelwe kwakunye nendlela u-Eskom aza kwakha ngayo eli ziko.

5.3.1 Iindledlana zokungena kweli ziko

Xa kufunyanwa isiGunyaziso sezokusiNgqongileyo (i-EA) naxa sele sithatyathiwe isigqibo sokuba kwakhiwe, iindledlana eziza kweli ziko ziza kuqalisa ukwakhiwa kulandelwa imigqaliselo ye-NEMA kunye nezinye izinto ekufuneka zilunyukelwe ebezichaziwe ngethuba le-EIA.

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Iindlela ezinkulu ezikumgama oyi-35 km ukusuka kule ndawo kuza kwakhiwa kuyo e-Thyspunt (jonga kuMfanekiso 12) ochazwe apha ngezantsi.

Uhola wendlela ongu-N2, okude ngomgama ozikhilomitha ezingama-21,5 kumantla esi siza, uza kusetyenziswa njengendlela esuka ngasempuma iye ngasentshona, njengoko eyiyeyona ndlela inkulu idibanisa iBhayi neKapa. Zikhona iziphambuka ezine ezinendlela elungisiweyo apha ku-N2 ezikumgama ozi-35 km. Ezi ziphambuka zezi:

- Isiphambuka esidibanisa ku-R102 eMondplaas
- Isiphambuka esingena eJeffrey's Bay
- Isiphambuka esidibanisa ku-R330 emantla eHumansdorp
- Isiphambuka esidibanisa ku-R62 eTrifolia

U-R102 yindlela efakwe itha enemizila emelene no-N2, kwaye yayikade iyindlela enkulu esetyenziswayo edibanisa iBhayi neKapa phambi kokuba kwakhiwe u-N2. Ngoku isetyenziswa njengendlela yokungena kwiindawo ezingamaphandle.

U-R62, oyindlela ekumgama oyi-19,7 km ngasemntla-ntshona, yindlela efakwe itha enemizila emibini, engena eLangkloof nakwezinye iindawo ezingabamelwene. Ikudidi lweendlela zengingqi/iphondo kodwa iyasetyenziswa ngabo baya eNtshona Koloni xa bengafuni ukuhamba ngezi zesiqhelo.

U-R330, okumgama ozikhilomitha eziyi-11,3 km empuma yomntla-mpuma, usetyenziswa njengendlela yengingqi esuka emntla iya entshona phakathi kwedolophu yaseHankey, Humansdorp naseCape St. Francis, kwaye yiyona ndlela inkulu kulo mmandla imi kuwo iThyspunt.

U-R332 yindlela yasemaphandleni engefakwanga tha edibana ku-R330, nekumgama omalunga neekhilomitha eziyi-6,0 emantla eHumansdorp.

5.3.1.1 Iindlela eziya eThyspunt

Zimbini iindlela ezithathwa ngokuba zindlela eziya eThyspunt ngolo hlobo ziphungule ugxalathelwano okanye ingxinano yezithuthi ibinokwenzeka ukuba ibinye, oku kuza kuphungula uphazamiseko obelunokwenzeka kuluntu ngokuphindiweyo. Ezi ndlela yile ivela ngasentshona (engenwa nge-Oyster Bay road) kunye nale ivela ngasempuma (engenwa ngo-R330) (jonga kuMfanekiso 16).

5.3.1.2 Indlela zokuhlangula ngexesha likaxakeka

Ziyafuneka neendlela ezimbini eziphuma kule ndawo inezisa ezinokusetyenziselwa ukuhlangula nokubalekisa abasebenzi xa kunokuthi kwenzeke ilishwa lokuba kubekho ingozi. Aza kwenziwa

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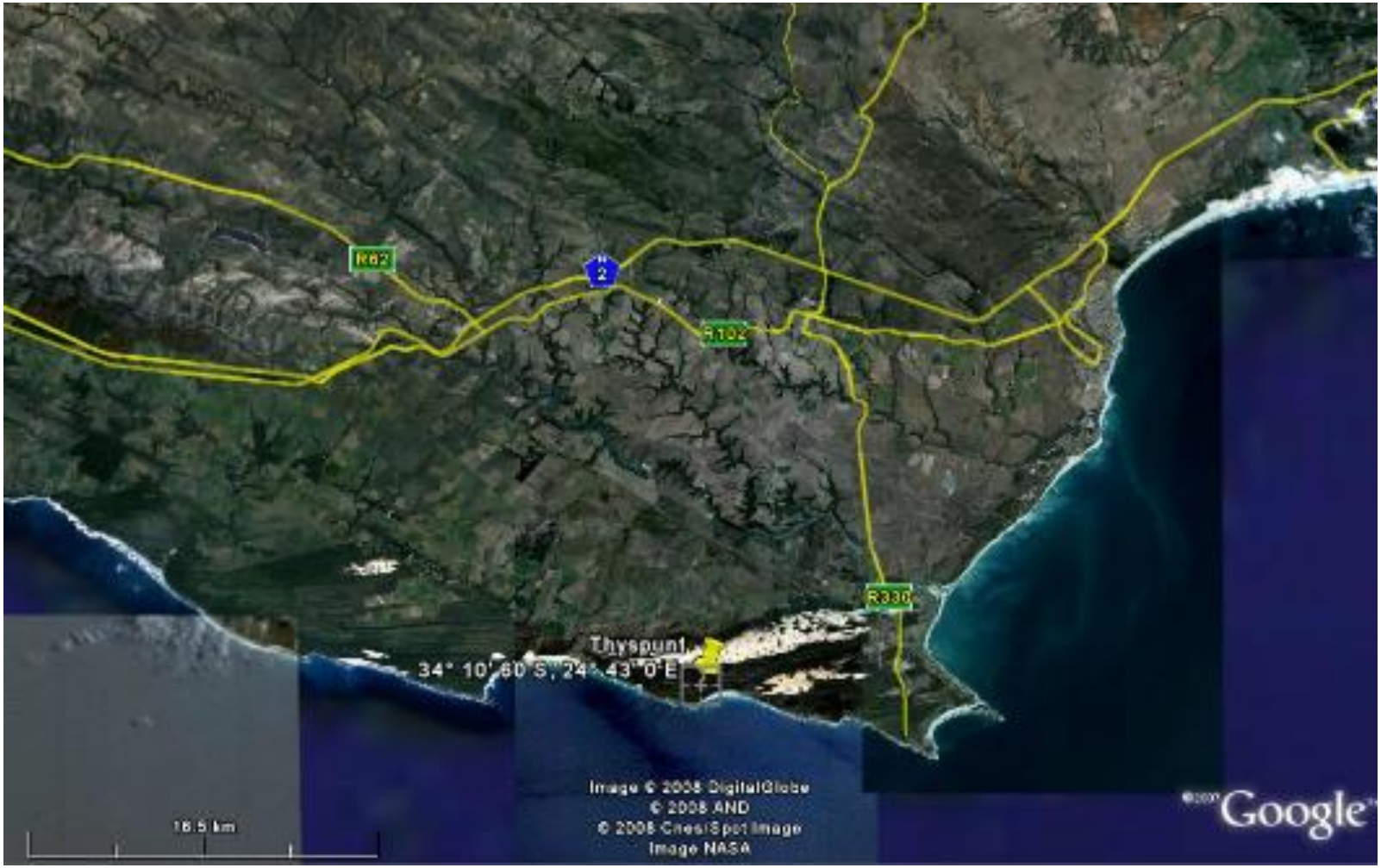
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namanye amalungiselelo anxulumene nokubalekiswa kwabasebenzi/abantu ngokukhawuleza xa kuthe kwavela ingxaki. La malungiselelo aza kwenziwa namagosa aseburhulumenteni ale ngingqi ngokunjalo nezicwangciso zolawulo lwentlekele sakuba isigqibo esicacileyo sithathiwe malunga nokwakhiwa kweziko eliphehla inyukliya.

5.3.1.3 Ukuthuthwa kwemithwalo emikhulu

Ubuxhaka-xhaka obuninzi beziko lokuphehla inyukliya benziwe kumazwe aphesheya kwaye buhanjiswa ngolwandle, kwaye uninzi lobu buxhaka-xhaka zintsimbi ezinkulu kakhulu xa zithelekiswa nemithwalo yesiqhelo ehanjiswa ezindleleni. Kufuneka ikhona indlela yokuthutha imithwalo emikhulu ngokugqithisileyo iye kule ndawo kwakhiwa kuyo. Uninzi lweentsimbi ezinkulu ngokugqithisileyo iza kuhanjiswa ngeenqanawa elwandle ize yothulwe kwizibuko laseBhayi njengoko ilelona zibuko likufutshane eThyspunt likwaziyo ukothula imithwalo emikhulu. Ukusuka apha le mithwalo mikhulu iye ithathwe isiwe eThyspunt kusetyenziswa iiloli eziza kuhamba ngo-N2. Ukusuka ku-N2 indlela eya eThyspunt efakelwe itha iya eHumansdorp, igqithele eFrancis Bay (jonga kuMfanekiso 15). Le ndlela isuka ngasempuma yiyo ekuchazwe ngokuba yiyona ingcono xa ufuna ukulayisha imithwalo emikhulu ngokugqithisileyo eza apha. Umsebenzi oza kwenziwa ukuphucula nokutshintsha ezi ndlela uza kwenziwa rhoqo ukulungiselela ukuba zisetyenziswe xa eli ziko liqala ukusebenza.

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UMfanekiso 10: Iindlela ezinkulu ezikumgama oyi-35 km ukusuka kwisiza esiThyspunt

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5.3.2 Ukombiwa komhlaba omninzi

Bakuba oosiganda-ganda abakhulu bezisiwe kule ndawo kuza kwakhiwa kuyo, uza kuqalisa umsebenzi wokutshenta nokukrwela umhlaba kulungiselelwa ukwakha ii-Ofisi zethutyana zika-Eskom, iZiko leMibuzo, iSakhiwo sokuHlala abaSebenzi, iziko lethutyana lokuhluza ityuwa kumanzi olwandle, amatanki amanzi aselwayo, izindlu zangasese zethutyana, itanki lokucoca amanzi asele esetyenzisiweyo, indawo yokumisa izithuthi kunye neyadi yabasebenzi.

Ziza kukhangelwa ezi ndawo zilandelayo:

- eyokugalela imfungu-mfungu
- eza kuba libala lokuhlala inqwelo-ntaka
- eza kugalela umhlaba ogrunjiweyo

Emva koko, uza kuqalisa umsebenzi wokugrumba udonga lokuxhasa i-NPP kwakunye nezokuxhasa ezinye iindonga. Umhlaba namatye agrunjiweyo kuza kugangathwa ngawo kwezinye iindawo. Lakuba udonga lokuxhasa i-NPP ligqityiwe lanalo mphakamo ufunekayo, uza kuqalisa umsebenzi wokugrumba kubhekwe ezantsi. Olu hlobo lokomba luza kufuna kukhanywe amanzi kodwa ngendlela engazikuchaphazela imimandla yezolondolozo elijojo. Lo umsebenzi ungathatha ixesha elinokude lifike kwiinyanga ezisibhozo ngaphambi kokuba lo wokugrumba uqale.

Indawo yokugcina izixhobo zokusebenza iza kwakhiwa kule santi ikule ndawo kwakhiwa kuyo ukuze lo mhlaba ugrunjiweyo uphinde usetyenziswe ukunqanda inkxamleko yokulahla umhlaba ongasetyenziswanga.

Umphakamo wodonga lokuxhasa i-NPP kufuneka ulingane nomphakamo oza kukwazi ukuthintela ukutyhoboza kwamanzi olwandle, futhi ube zimitha ezi-2 ukusuka kumanzi asemathunjini omhlaba, ngolo hlobo kuphungulwe umthamo wesanti eza kulahlwa kunye namanzi abandayo okupholisa aza kufuneka kweli ziko lokuphehla inyukliya lisasebenza.

Umchwe oza kuvuthuluka uphele uza kwakhiwa kusetyenziswa izinto zokwakha ezisuka kwenye indawo kuwo onke amadonga okuxhasa i-NPP ekuza kuhanjwa kuwo ngabakhi nezithuthi zokwakha. Lo mchwe kufuneka ukwazi ukuthwala ubunzima obuyi-150 KPa kwezi ndawo zethutyana zokugcina izixhobo zokusebenza. Indlela aza kwakhiwa ngayo la madonda kufuneka ivumele ukuba amanzi emvula akwazi ukuhamba aye kwimibhobho yokuhamba amanzi eza kufakwa ngeli thuba kwakhiwayo. Iindlela ezinkulu zokuza kule ndawo kwakhiwa kuyo ziza kulungiselelwa xa kwakhiwa la madonga angamathambeka kodwa indlela eya kwiyadi yokugcina izixhobo zokwakha iza kwakhiwa lelinye iqumrhu. Kufuneka kukhunjulwe ukuba iza kuguga indlela ngeli thuba kwakhiwayo kwaye oku kuza kubekwa phantsi kweliso kuze kulungiswe lelinye iqumrhu xa kukho imfuneko. Ezinye izinto eziza kulungiselelwa xa kusakhiwa udonga lokuxhasa

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ngamanzi atyiwayo kunye nezivalo zeempompo zezicima-mlilo, ibhokisi yombane encedisa ngombane ukuze kukhanyiswe kule ndawo kwakhiwa kuyo, imibhobho yamanzi ezikhukhula kunye nemibhobho yezindlu zangasese.

Uza kuphawulwa ngokufanelekileyo umphetho wezi ndonga zokuxhasa ukulungiselela ukhuseleko, ngokuthi ufakelwe iintsimbi okanye ucingo. Le ndawo kwakhiwa kuyo iza kubiyelwa ngocingo olomeleleyo kwakuba kugqityiwe ukugrumba kule ndawo iza kuba nesakhiwo.

Amatye agrunjwe kwitonela lokungenisa amanzi okupholisa nakwindawo yokugcina isiphehli-nyukliya kunye neyokugcina injini yokuphehla inyukliya angasetyenziswa xa kuditywa okanye athuthwe asiwe kwikwari ekufutshane ukuze aqhekezwe elungiselelwa ukusetyenziswa kwezinye izinto.

5.3.3 ITanki eliKhulu laManzi aSelwayo

Liza kwakhiwa itanki elikhulu lamanzi aselwayo. Ngoku usaqalayo umsebenzi wokwakha amanzi aselwayo okanye atyiwayo afunekayo aqikelelwa ukuba aza kuba yi-1,05 l/s. La manzi angakhiwa kwiindawo ezininzi ngokuye umsebenzi wokwakha uqhuba. Ekuqaleni amanzi aselwayo aza kukhiwa kwimingxuma yokumpompa amanzi ekhoyo kodwa la amanzi angafuna ukuqala acocwe. La manzi aza kugcinwa kumatanki axhonywe phezulu. Iza kuthi xa le ndawo kuza kwakhiwa kuyo nayo xa iqala ukulunga namanzi aza kuqalisa ukufuneka ngamandla. La manzi aza kufumaneka ngokuthi kubekho amatanki amaninzi okugcina amanzi aza kubekwa kwiindawo eziphakamileyo. La matanki aza kukwazi ukumpompa ngokwaneleyo ukuze kuphume amanzi okusela, aza kusetyenziswa kwizindlu zangasese kunye naza kusetyenziswa kwezinye izinto ezingafuni manzi aphuma kokutsiba ngoku zisakhiwayo izakhiwo zethutyana nezisisigxina. Apho kukho imfuneko angafakelwa umatshini oza kukhupha ngokukhawuleza.

Xa iindonga ezininzi zigqitywa ukwakhiwa, imibhobho yokuhambisa amanzi iza kufakelwa. Amanzi aza kuphuma kwiziko lokuhluza ityuwa kumanzi olwandle (yona ekufaneleke ukuba sele igqityiwe ngeli xesha) aze athunyelwe kumatanki amakhulu okuwagcina, wona athi awathumele kwimibhobho yamanzi. Iza kuba khona nendawo ekuza kukhiwa kuyo kufakelwe neminye imibhobho edlulisela amanzi kwezinye iindawo.

Amanzi aneleyo aza kugcinwa kwiindawo ezahlukeneyo kule ndawo kwakhiwa kuyo ukulungisela ukuba afumaneke lula kwiindawo afuneka kuzo afumaneke naxa kunokuthi kuvele ingxaki (umz., umlilo) okanye ukuvalwa okucetyiweyo. Kufuneka ankinkishwe ngendlela ukulungiselela amaxesha ahlukeneyo omsebenzi asebenzisa umthamo wamanzi ongafaniyo. Kufuneka amatanki ahlale anamanzi alingana nomlinganiselo wamanzi asetyenziswa iiyure ezingama-48 xa ebalwa ngokomyinge wosuku wonyaka, nangona zikhona iimeko ezinokufuna ukuba kuhlale kukho elugcinweni amanzi angumlinganiselo wamanzi asetyenziswa iiyure ezingama-24.

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Umthamo ogcinwe kumatanki axhonyiweyo okugcina amanzi, ukulalelisela xa kunokuthi kucime umbane, kufuneka ulingane nomthamo wamanzi osetyenziswa iiyure ezi-2 ukuya kwezi-4 ngamaxesha asetyenziswa kakhulu ngawo amanzi. Amandla empompo enkulu yamanzi kufuneka akwazi ukumpompa amanzi aphuma ngesantya aqhele ukuphuma ngaso ngethuba kusetyenziswa amanzi kakhulu.

5.3.4 Imibhobho yamanzi ezikhukhula

Njengoko kuchaziwe phantsi komsebenzi wokugrumba umhlaba omninzi, imibhobho yamanzi ezikhukhula iza kuqukwa xa kusakhiwa iindonga zokuxhasa i-NPP.

Amanzi emvula aza kuqokelelwa ngokuthi kusetyenziswe iindlela, imibhobho yamanzi ezikhukhula kunye nemisele evulekileyo. Imisele yiyona ingcono kuba ayibizi mali ininzi futhi ayifuni nakukhathalelwa kangako.

Phambi kokuba aphuphumele ngaphandle, amanzi emvula aza kugqitha kumachibi okulondoloza indalo/okanye awokuhluza intlenga enzelwe ukuqokelela zonke izinto ezingelolwelo eziphuma emanzini nakwi-oyile ukuba kukho amathuba okuba kwenzeke ungcoliseko. Emva koko, aza kuchithelwa kutyani apha phezu kwethambeka lokuxhasa lona linendlela yokuwathoba isantya ukuze angenzi ukhukhuliseko kwezi ndawo aphuma kuzo.

Amanzi emvula angathunyelwa kwitanki lamanzi abandayo okupholisa xa seliqalile ukusebenza.

Uphando lubonisa ukuba amanzi ahlalayo ahambe kancinci kumaqula okugcina amanzi ayayiphazamisa imijelo nemihlaba elijojo, ingakumbi xa le mijelo nemihlaba ilijojo sele iqhele amanzi abalekayo. Amanzi amileyo akwayindawo yokuzalela iingcongconi nezifo ezithile. Yiyo loo nto umba wokusetyenziswa kwamaqula okugcina amanzi kuza kufuneka uqwalaselisiswe ukuba ikhona into ethi aza kusetyenziswa kule ndawo kwakhiwa kuyo.

5.3.5 Imibhobho yokuhambisa ilindle

Ngethuba usaqala umsebenzi wokwakha kuza kusetyenziswa izindlu zangasese ezisebenzisa iikhemikhali eziza kufunyanwa kwiqumrhu elizimeleyo. Kuza kusetyenziswa amatanki olondolozo njengendawo zokuqokelela lonke ilindle kule ndawo kwakhiwa kuyo. Eli lindle liza kuthathwa kula matanki lisiwe kumaziko kamasipala ukuze liye kucocwa.

Lakuba iziko lokucoca ilindle lethutyana (i-STP) sele liqalisiwe ukwakhiwa futhi nemibhobho yokuhambisa ilindle sele ifakelwe, amanzi anelindle aza kucocwa kule ndawo kwakhiwa kuyo. Le STP yethutyana kungafuneka ithuthwe isiwe kwindawo eza kubekwa kuyo naphakade lakuba udonga lokuxhasa i-NPP ligqityiwe ukwakhiwa. I-STP ayizikudityaniswa nale ndawo inesiphehli-nyukliya futhi onke amanzi amdaka anokuba angenwe yimitha enobungozi aza kucocwa kwindawo yawo yodwa, kodwa kwalapha kwesi siqithana sesiphehli-nyukliya.

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Zinganinzi iindawo zokuqokelela ilindle kodwa kuza kuqinisekiswa ukuba ezi ndawo zimbalwa ukunqanda ukuba kungabikho maziko okumpompa akhiwayo amaninzi. La maziko wona aza kuthumela ilindle kwi-STP.

5.3.6 Iziko leBhokisi yoMbane

Umbane walapha uza kube neentambo eziyi-11 kV ezitsala umbane kwiziko elincinci lombane okanye kwiziko lokukhanyisa. Iziko elincinci lombane ekuqaleni liza kuthunyelelwa umbane ngentambo eyi-22 kV esuka kwezi ntambo sele zikho kule ngingqi. Ezi ntambo ziza kongezwa ngenye eyi-132 kV ngeli thuba umsebenzi wokwakha uqhuba. I-132 kV iza kutswetywa iye ku-11 kV.

Le ntambo iyi-11 kV iza kuthumela umbane kumanye amanzi amancinane ombane kwiindawo ezahlukenyo ezifuna umbane kule ndawo kwakhiwa kuyo. Le 11 kV iza kuphungulwa ize ithumele i-400 V *3-phase* kwiqumrhu elizimeleyo eliqeshiweyo. I-400 V ngumlinganiselo wamandla ombane omiselweyo eMzantsi Afrika kuhlobo lombane onamandla kakhulu. Intambo yombane eyi-11 kV iyakwazi nokufaka umbane oyi-11 kV ngqo kwiqumrhu eliqeshiweyo ukuba kukho imfuneko.

Indawo elikuyo iziko, umzekelo, kwisikhululo esincinci sokucima nokukhanyisa, isikhululo sombane esincinci kuza kuthathwa isigqibo ngayo emva kokuba kuqwalaselwe le miba ilandelayo:

- Ingxinano yabantu neyezithuthi
- Ifuthe kwindalo
- Amanzi
- Ungcoliseko
- Ukufikeleleka kuyo ukuze kube lula ukusebenzisa kulo nokulikhanda
- Indawo ezikuyo ezinye iinkonzo ezihamba phantsi komhlaba, umzekelo iingcingo zonxibelelwano, imibhobho yamanzi, njl njl.

5.3.7 Izibane zangaphandle

Kwisithuba saphambi kokuqala komsebenzi wokwakha, iindawo ezifuna izibane kakhulu yiNdlela yokuNgena ngaseMpuma, iZiko lokuGcina iziXhobo zokusebenza, iYadi yeSikhululo soMbane esiNcingci kunye nee-Ofisi zika-Eskom zale ndawo kwakhiwa kuyo.

Uninzi lwezinto eziza kukhanyisa, ingazipali zombane okanye ibe zibhalbhu ezibekwe emhlabeni phantsi ziza kuba nobuchwepheshe bokuba zizikhanyele ngokwazo, into ethetha ukuba ziza kukhanya ukusuka ngorhatya ukuya kutsho ekuseni ukwenzela ukhuseleko.

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Iindledlana ezincinci kunye nezakhiwo ezikufutshane kule ndawo kwakhiwa kuyo ziza kukhanyiswa nazo ukwenzela ukuba iimoto nabantu bakwazi ukuhamba-hamba. Izibane azizikukhanya zide ziphandle. Abantu abazikukhathazwa ukuba basebenzise iithotshi ezikhanyisa kakhulu kunye nezibane ezinesithatha esihlabayo.

Akhona amalungiselelo okulalelisela okusebenzisa isibane esixhonywa phezulu kwiindawo ezithile kule ndawo kwakhiwa kuyo.

5.3.8 Unxibelelwano

Ubuxhaka-xhaka, izakhiwo kunye neepali zonxibelelwano ukulungiselela unxibelewano kule ndawo kwakhiwa kuyo ziza kwakhiwa ziqalise ukusebenza njengoko umsebenzi wokwakha nawo uqhuba.

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6 INKCAZA YESIZA NESIZATHU SOKWAKHIWA KWASO

Ngokwemithetho yeli, ingakumbi u-RG-0011 (*Interim Guidance on the Siting of Nuclear Facilities*) kunye noMthetho-mmiselo R.927 (*Regulation on Licensing of Sites for New Nuclear Installations*), isicelo sokufumana ilayisenisi yendawo yokwaka isiphehli-nyukliya kufuneka sithathele ingqalelo le miba ilandelayo xa kuqwalaselwa ukuba indawo leyo ikulungele na ukwakha isiphehli-nyukliya:

a) Umonakalo oweziwa zizinto zangaphandle ezenzeka kule ngingqi kuza kwakhiwa kuyo (ezenziwa ngabantu okanye zendalo);

b) Iimpawu zale ndawo kunye nokuyingqongileyo ezinokuchaphazela imitha enobungozi ephuma isiya ebantwini; kunye

c) Nengxinano yabantu, kwakunye nezinto ezinokufuna ingqwalasela xa kuthathwe amanyathelo akhawulezileyo kuba kuvele ingxaki kunye naxa kuvele imfuneko yokuba kuhlolwe umngcipheko ababekwa kuwo abantu.

Le ndawo iyakuba ayifanelekanga ukuba inezinto engenazo ezingenakuncedwa:

- Nalutshintsho olunokwanziwa kwindlela ekuza kwakhiwa ngayo
- Nangamanyathelo ezokhuselo; okanye
- Nazinkqubo zolawulo.

Inkcaza emfutshane yale ndawo inikiwe apha ngezantsi.

6.1 INKCAZA EPHELELEYO NGE-THYSPUNT

IThyspunt iphantsi komasipala wesithili saseSarah Baartman, onomhlaba onobukhulu obumalunga ne-60 000 km^2 kwintshona yePhondo laseMpuma Koloni. Iphantsi komasipala wengingqi waseKouga. Zonke iindawo neziseko zophuhliso ekuthethiweyo ngazo apha ngezantsi zibonisiwe kuMfanekiso 15. IThyspunt ikunxweme olusemazantsi kwisithuba esizikhilomitha ezi-4 ukusuka e-Oyster Bay, kumgama ozikhilomitha ezili-12 entshona ye-St Francis Bay ibe kumgama okude ngeekhilomitha ezili-17,3 emazantsi eHumansdorp (lo mgama ulinganiswa usuka embindini wale ndawo kuza kwakhiwa kuyo ukuya kutsho kumda ongowona ukufutshane wedolophu ekufutshane). Umbindi we-Thyspunt umi ngolu hlobo X: -27 522,999 806 kunye Y: -3 784 463. Iindawo ezizidolophu ezinkulu ezikumgama ozikhilomitha ezingama-80 kule ndawo yiBhayi neTinarha.

Akukho hola wendlela unqumla kule ndawo kuza kwakhiwa kuyo. U-N2 ugqitha esuka ngasempuma esiya ngasentshona kumgama omalunga ne-22 km ngasemantla kule ndawo.

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Indlela efakwa itha eza apha iya eHumansdorp ize enye indlela enkulu eza apha ibe yindledlana encinci engafakwanga itha kodwa imeko ayimbanga kakhulu iya e-Oyster Bay. Enye indlela enokusetyenziswa ofika kuyo ngokusebenzisa indlela engafakwanga tha yindlela efakwe itha yona engu-R330 esuka eHumansdorp isiya eSt Francis Bay. Ezi ndlela zilandelayo nazo zingasetyenziswa (jonga kuMfanekiso 15 kunye noMfanekiso 16);

- I-Oyster Bay Road kodwa ungangeni e-Oyster Bay uze kule ndawo usuka ngasentshona;
- U-R330 onesiphambuka esiya eSea Vista uvele ngasempuma xa usiza kule ndawo;
- U-R330 uze usebenzise le ndlela ikhoyo ifuna ukulungiswa ize idityaniswe ne-Oyster Bay Road

Kukho amaphulo amakhulu olimo kule ngingqi, elona likufutshane ngamadlelo eenkomo zobisi, elikumgama oyi-3 km ukusuka apha kunye nelezilimo ezinkckenkceshelwayo elikumgama oyi-5 km ukusuka apha. Le ndawo iphakathi kwemilambo emibini, iKrom River ngasemntla-mpuma kunye neSlang River ngasentshona kwindawo enamadama okugcina amanzi. Akukho milambo kule ndawo kuza kwakhiwa kuyo kodwa ikhona imimandla enemihlaba elijojo kunye nemithombo etsitsa amanzi. Imihlaba elijojo ifumaneka kulo ndawo inotyani neendawo ezineenduli zesanti ize imithombo yona ibe ngaselunxwemeni.

Le ndawo ngasemazantsi ivalwe yi-Indian Ocean. Unxweme olunamatye amakhulu lujonge ngasentshona yomntla-ntshona nangasempuma yomzantsi-mpuma kwaye inamatye okuthomalalisa amaza alwatyuzayo. Le ndawo ingumhlaba ingena ngaphakathi ihamba umgama omalunga ne-3 km kwaye uneenduli zesanti eziphakamileyo ezithe thantala ngasempuma yomntla-mpuma ngenxa yomoya wolwandle. Induli zesanti zalo mmandla zigqunywe lutyani ngeli thuba kukho umchwe ongena ngaphakathi ongenalutyani, iinduli zesanti ezihamba nomoya zihamba ziyokufika e-Oyster Bay ziye ngaseSt Francis Bay. Ezi nduli zichazwa njengeenduli eziphephethekayo nezihamba nomoya.

Eyona ndawo iphakamileyo yezi nduli zesanti ikude kangange-2 km elunxwemeni kwaye iphakame kangange-100 m, futhi ezona nkcochoyi ziphakamileyo ziyi-111 m ne-122 m ukuphakama. Iinduli zesanti ezinotyani eziphakathi kwale ndawo nonxweme ziphakame kangange-70 m ukuya ku-80 m ize eyona imfutshane ibe yi-20 m ukusuka kunxweme olunamatye. Apha ngaphakathi emhlabeni ukusuka kwiinduli zesanti umhlaba uye uqalise ukuphakama kakuhle ude ube yintatyana engaphakamanga ejonge ngasemntla-ntshona ukuya ngasemzantsi-mpuma uze umphakamo wayo kwinkcochoyi yayo ibe yi-170 m. Le ntatyana imalunga ne-6 km ubude apha ngaphakathi.

Amabala okuhlala iinqwelo-moya kulo mmandla uninzi lwawo ngamabala amancinci abucala kunye nalawo okuhlala iinqwelo-ntaka xa kukho ingxaki engxamisekileyo asezifama. Uninzi lwawo ngamabala angabhaliswanga ngokusesikweni asetyenziswa ngabantu bewasebenzisela iingxaki zabo futhi awanazakhiwo okanye iziseko ezifanelekileyo. Isikhululo seenqwelo-moya esikhulu esikufutshane eThyspunt yiPort Elizabethi International Airport, ekumgama oyi-85 km

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ngasempuma. Sinye isikhululo seenqwelo-moya esincinci esibhaliswe ngokusesikweni, esingumgama iyi-16 km ukusuka eThyspunt, eso yi-St Francis Airfield (esikumgama oyi-10,8 km ngasempuma). Eli bala linomzila omnye onengca oyi-10/28, ubukhulu bawo yi-1 000 x 23 m. sivulwa yonke imihla kodwa asinaso isakhiwo samagosa alawula ukuhlala nokuhamba kweenqwelo-moya, kodwa sinazo izibane kumzila wokuhlala kweenqwelo-moya kwaye sinezakhiwo ezili-13 zokugcina nokukhanda iinqwelo-moya ezincinci ezizezabantu. Akukho mafutha eenqwelo-moya okanye ezinye iikhemikhali ezinobungozi ezigcinwa apha. Iinqwelo-moya ezincinci, oko kukuthi, ezo zihamba ngephiko, iinqwelo-ntaka kunye neenqwelo-moya eziluhlobo lwe-*Lear jets* (<5,7 t ngokwenkcaza ye-ICAO) zisebenziseza eli bala. Inqwelo-moya ezingena kwesi sikhululo ngonyaka zimalunga ne-100. Ngokwangoku akukho zicwangciso zokusivula esi sikhululo. Akukho maziko ezomkhosi akwisithuba esingama-80 km ukusuka eThyspunt.

Akukho sporo sikaloliwe sinqumla eThyspunt. Inxalenye yomzila osuka eBhayi uye e-Avontuur, isiporo sikalolilwe esingenambane, sikumgama oyi-21,3 km emantla eThyspunt. Oololiwe abasebenzisa esi siporo baquka oololiwe abalayisha impahla abathathu abahamba ngedizili nombane abagqitha apha kathathu ngeveki, belayishe imithi esuka e-Assegaaibosch isiya eBhayi. Esi siporo sikwasetyenziswa nayi-Apple Express, uloliwe wabakhenkethi walapha. Akukho zicwangciso zikhoyo zokwakha isiporo sikaloliwe esitsha kumgama oyi-16 km ukusuka eThyspunt.

Izibuko laseBhayi nelaseNgqura (Coega) ngawona mazibuko makhulu ezorhwebo kuwo wonke lo mmandla kwaye akumgama oyi-80 km ukusuka kule ndawo siza kwakha kuyo. Izibuko elincinci lamaphenyana lasePort St. Francis likumgama oyi-13,9 km ngasempuma. Eli zibukwana linechweba elinendawo yokugcina amaphenyana okuloba, kunye neepali zekhonkolo zokukhuleka amaphenyana, kunye nendawo yokungenisa (kwalapha ngaphakathi kweli zibuko) amaphenyana amancinci okudlala. Akungenwa ngaphandle kwemvume kweli zibukwana kwaye ikhona nenqununu yezibuko eqeshelwe ukuba liliso leli zibuko.

Ezi zinto, oko kukuthi, amazibuko, amabala okuhlala iinqwelo-moya, njl njl, ziyinxalenye yeempawu zeThyspunt ekufuneka zithathwe ngokuba zizinto ezibhekisa kumba:

a) wezinto ezinokuba yingozi evela ngaphandle kweli ziko lokuphehla inyukliya (i-NPS) ezinokuba yingozi kwi-NPS, umzekelo inqwelo-moya enokuntlitheka kwi-NPS ngolo hlobo idale ingxaki enkulu enxulumene nenyukliya/imitha enobungozi;

b) wohlobo lwezithuthi ezikhoyo kulo mmandla ezinokusetyenziselwa ukulayisha iimpahla ezi e-NPS. Umzekelo, izibuko laseBhayi lelona zibuko likhulu kulo mmandla kwaye liza kusetyenziswa njengendawo eza kufikela nekuza kuthunyelwa ngayo izixhobo zokusebenza ze-NPS ngethuba kusaqhuba umsebenzi wolwakhiwo kunye nanjengedawo ezakugcina amafutha eliziko xa sele likwinqanaba lokusebenza.

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I-Thyspunt iphantsi kommandla we-*Fish-Tsitsikama Water Management*. Noko kunjalo, umthamo omninzi wamanzi uvela kummandla wasemantla oMlambo iGqili eze ngeSundays River. Iindawo ezininzi ezigcina zize zimpompe amanzi asetyenziswa kule ngingqi nakuMasipala waseNelson Mandela Bay (i-NMBM) zibizwa ngokuba yi-*Algoa Water Supply System*. I-NMBM inoxanduva lokunika amanzi abantu baseHumansdorp kunye nabaseSt. Francis Bay ehamba ngombhobho obizwa i-Churchill esuka kwidama laseChurchill elinomthamo ozizigidi ezingama-26,3 m^3 nelase-Impofu (ngaphambili elalibizwa ngokuba yi-Elandsjacht) lona elinomthamo ozizigidi ezingama-32,1 m^3. Lo mbhobho usuka ngasempuma uye ngasentshona emazantsi ohola wendlela u-N2 ukusuka kula madama uye eBhayi, uze ube nesebe elingena e-St Francis Bay eliye lidibanise indlela efakwe itha yaseHumansdorp nase-St Francis Bay (u-R330) kufutshane phambi kokuba ufike kwibhulorho yaseKrom River. Iidolophana zalapha zifumana inxalenye yamanzi azo kumanzi atsalwa phantsi komhlaba.

Intambo yombane eyi-22 kV ihamba kumgama oyi-0,4 km emantla eThyspunt, enokuthi ithumele umbane omalunga ne-8 MVA. Intambo yombane entsha eyi-66 kV iza kufuneka eza kusuka kwisikhululo esincinci sombane saseSt. Francis Bay iye eThyspunt kwaye kulindeleke ukuba le ntambo ilandele le ndlela icetywa ukwakhiwa isuka eSt Francis Bay iza eThyspunt. Intambo entsha yombane eyi-132 kV kufuneka ifakelwe ukusuka kwisikhululo sombane esincinci saseMelkhout (kumgama omalunga ne-3 km emantla eHumansdorp) iye kwiyadi ye-HV ngaphaya kweenduli zesanti ukuze ikwazi ukugalela umbane oyi-30 MVA eThyspunt.

Ngokwengingqi, utshintsho ngokwendlela oza kusetyenziswa ngayo umhlaba kule ndawo iThyspunt ikuyo kulindeleke ukuba lwenzeke phakathi nakufutshane kwezi ndawo sele zihlala abantu. Naziphi na iindawo ezintsha ezakhiwayo zokuhlala abantu uninzi lwazo ziza kuba se-NMBM ikakhulu kummandla wophuhliso lwamashishini waseNgqurha. Amaphulo ezolimo kunye nawonkcenkceshelo kulindeleke ukuba angatshintshi, aqhube. Iidolophana zokuzonwabisa ezigudle unxweme kulindeleke ukuba zikhule njengoko kuphuhliswa ezokhenketho kulo mmandla. Nangona kulindeleke ukuba kubekho uphuhliso olukhoyo kwezi dolophana zihlala abantu kulo mmandla, kodwa kulindeleke ukuba uphuhliso lube mandla kwiidolophu ezineendawo zokuzonwabisa, apho kulindeleke amaphulo ophuhliso nokwakhiwa kwamashishini, ngaphandle kweli ziko lokuphehla umbane licetywayo eThyspunt.

6.2 IZAKHIWO EZICETYWAYO NENDLELA EKUZA KWAKHIWA NGAYO

Eli ziko lombane likhulu licetywayo njengoko libonisiwe kuMfanekiso 13 liza kuquka, phakathi kwezinye, iziphehli-nyukliya kunye nezakhiwo ezihamba naso ezifana:

Ngethuba kusakhiwa

- Umbhobho wethutyana wokulayisha amatye aza kwakha asuka elwandle; kunye
- Neendawo zokugcina izixhobo zokusebenza kunye nezinye izinto ezifuna ukususwa ngethuba kusakhiwa.

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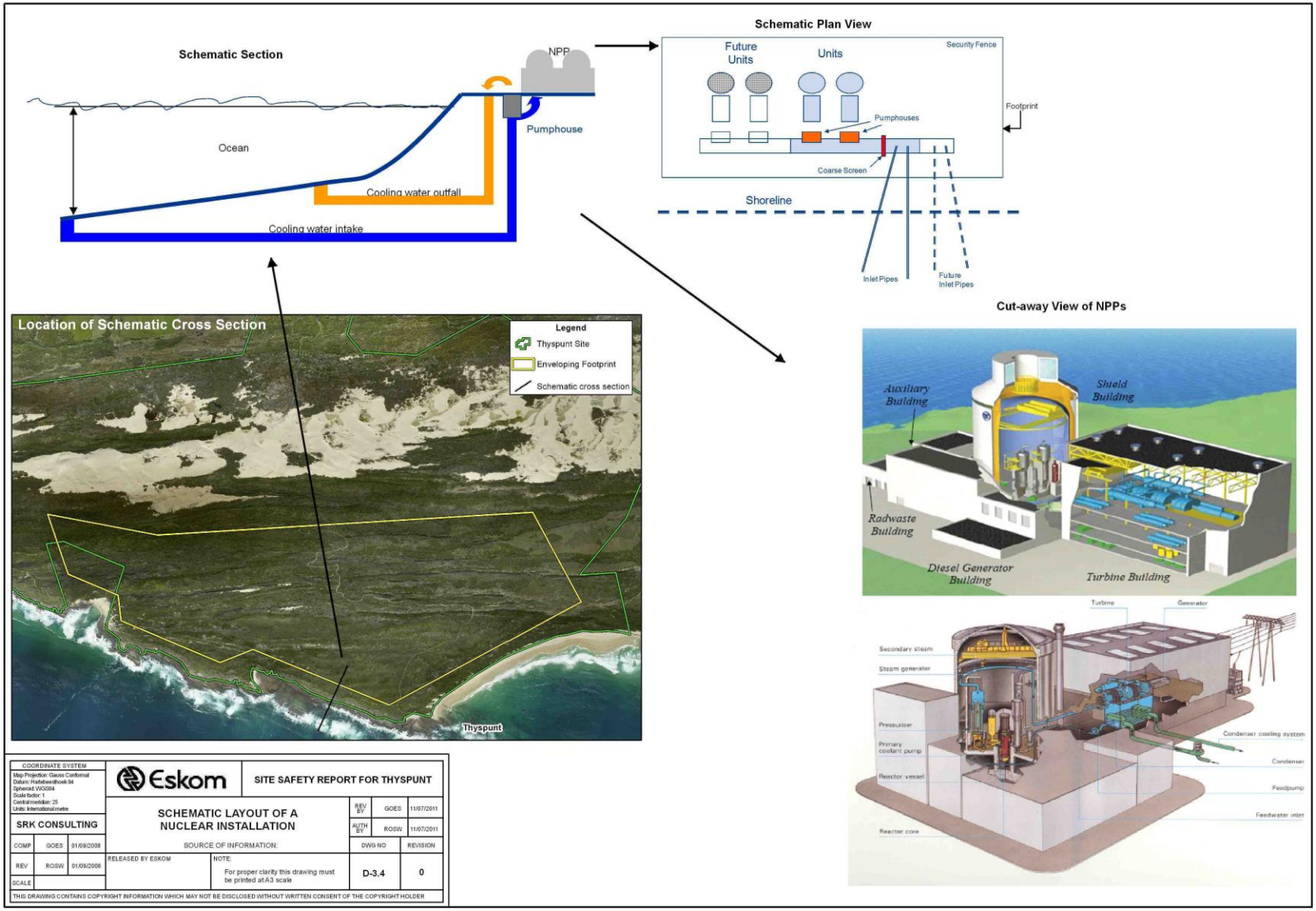
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Ngethuba uqalile umsebenzi:

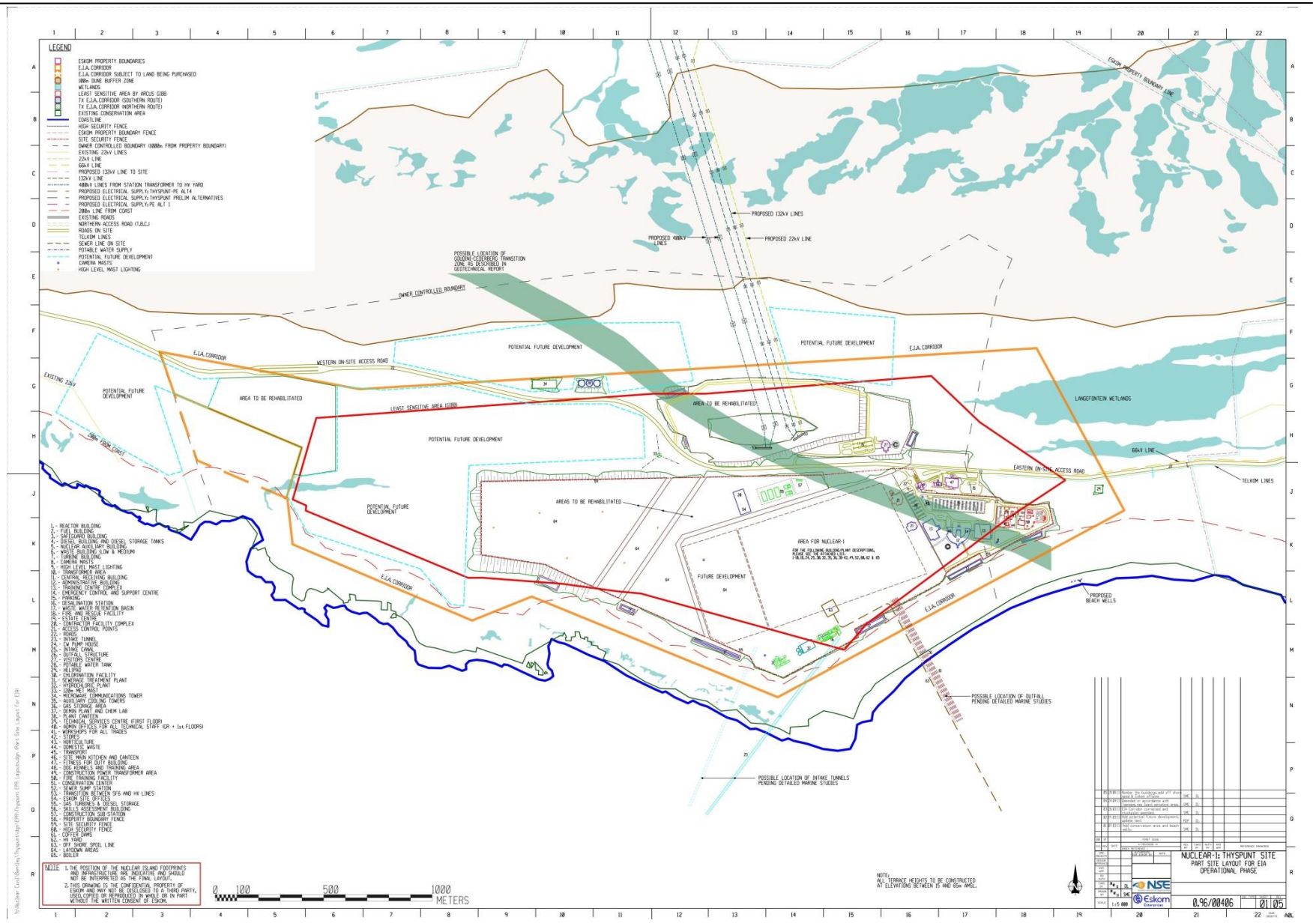
- Isakhiwo sesiphehli-nyukliya
- Ezinye izakhiwo zokuncedisa zesiphehli-nyukliya
- Amaholo eenjini
- Amafutha asebenzileyo kunye namaziko okugcina amafutha
- Iziko lehaydrojini
- Iinjini zedizili nezegesi
- Izakhiwo zokuhlela nokugcina izinto eziza kulahlwa
- Iziko lokucoca amanzi amdaka
- Imibhobho yokutsala nokukhuphela elwandle efunekayo ukuze ikhuphe okanye ifake amanzi okupholisa
- Iziko lokuhluza ityuwa kumanzi olwandle
- Iintambo zombane eziyi-132 kV kunye neziyi-400 kV zokusasaza nokutsala umbane kwisitishi sombane uye kwiyadi enombane onamandla kakhulu
- Iindlela
- Iyadi yombane onamandla kakhulu oyi-400 kV ne-132 kV (i-HV yard)
- Iintambo zokuhambisa umbane phakathi kwesitishi sombane kunye neyadi ye-HV (kule ndawo kuza kwakhiwa kuyo iseThyspunt kuphela); kunye
- Nezinye iziseko zeenkonzo zoncedo

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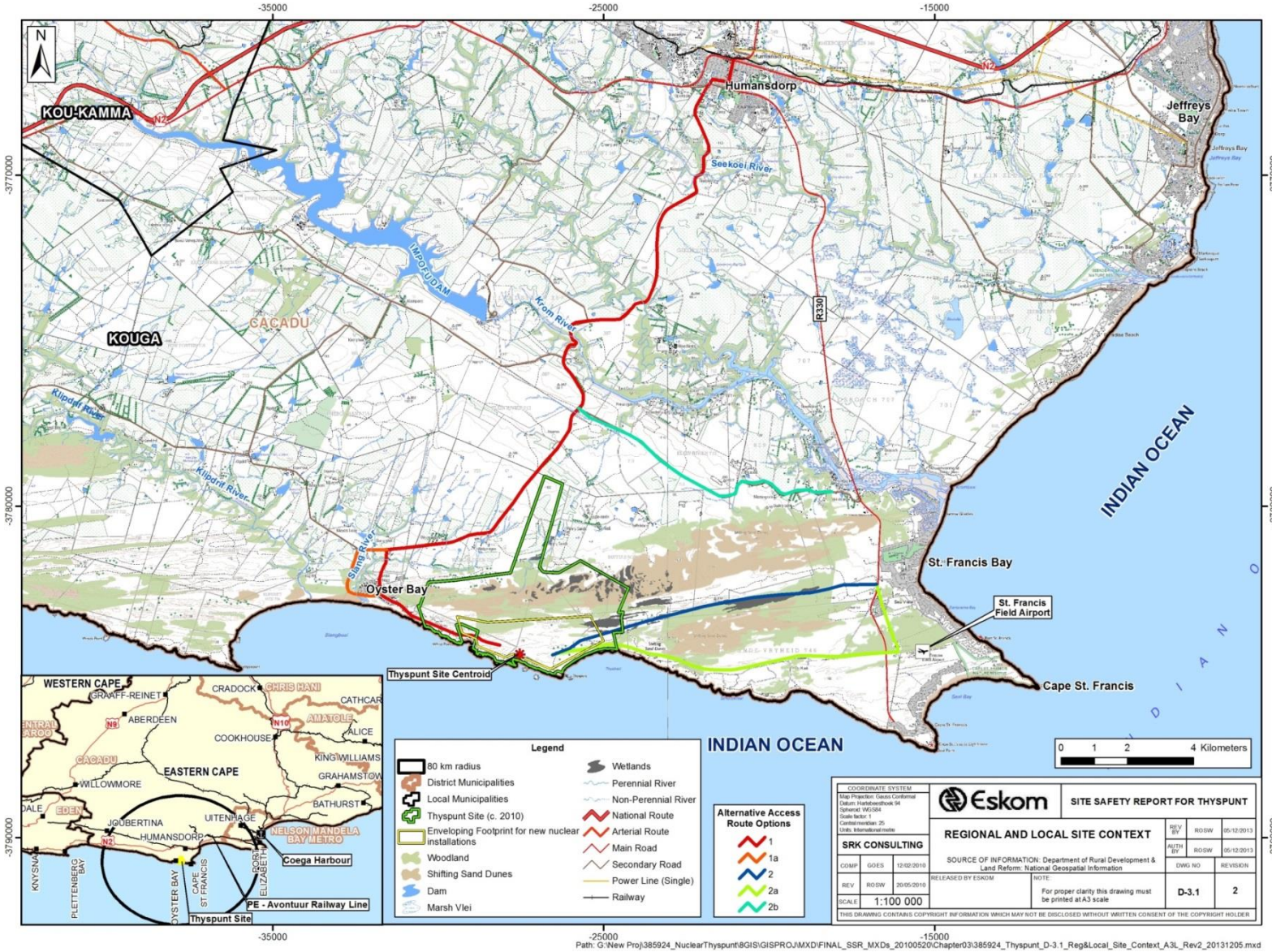
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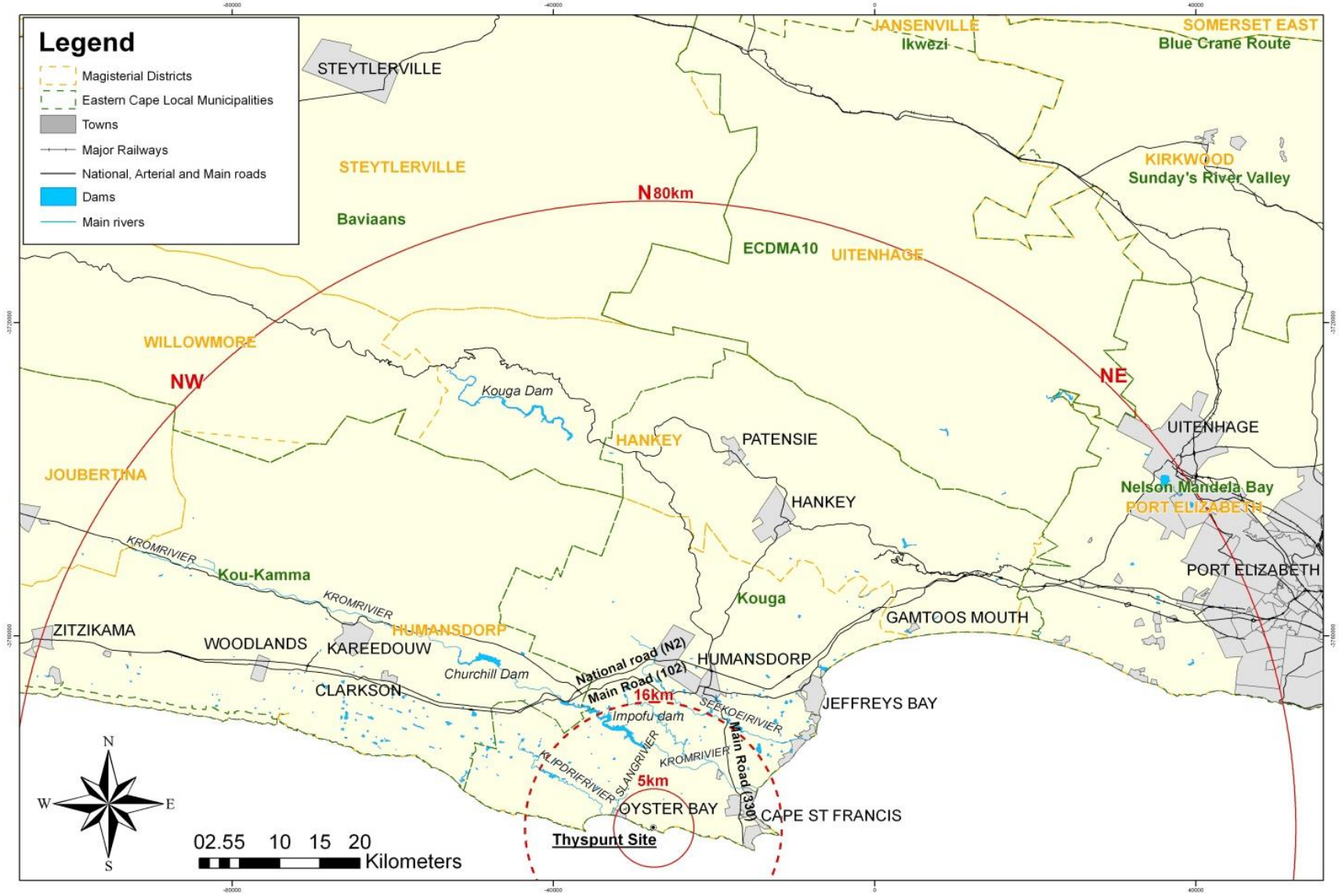
UMfanekiso 11: UMzobo wesakhiwo sesiphehli-nyukliya



UMfanekiso 12: Umzobo wesiza saseThyspunt



UMfanekiso 13: Umzobp wengingqi esikuyo isiza saseThyspunt



UMfanekiso 14: Iindlela ezinkulu kulo mmandla waseThyspunt (80 km)

6.3 ISIZATHU SOKUKHETHA LENDAWO

Uphando olubanzi luqhutyiwe ukuqinisekisa ukuba le ndawo yaseThyspunt ifaneleke kanye, kwaza kwathathelwa ingqalelo yonke imiba efanelekileyo kule ndawo kuza kwakhiwa kuyo (oko kukuthi, izinto ezenzekayo zendalo nezenziwa ngabantu, amathuba okuba imitha enobungozi ichaphazeeu uluntu nokusingqongileyo, ukuba isicwangciso sexesha likaxakeka singaqulunqwa futhi sisetyenziswe, ngokunjalo nesezokhuseleko njengoko oku kufuneka apha).

6.3.1 Uhlolo lwezinto ezinikwenzeka zangaphandle

Izinto ezenzekayo ezingaphandle kumsebenzi wokwakha isiphehli-nyukliya ezinokuthi zibangele umngcipheko kukhuseleko lwenyukliya ziboniwe zaze zaphononongwa. Le ndawo ikuyo iThyspunt kunye nobuxhaka-xhaka bokuqinisekisa ukhuseleko kwesi siphehli-nyukliya sicetywayo kufuneka ziqinisekise ukuba imithetho elawuwa ukhuseleko iyathotyelwa. Iintlobo ezimbini ezibalulekileyo zezinto ezenzekayo zangaphandle zezi:

- Izinto zendalo, umz., izikhukhula ezibangelwa yimozulu embi kakhulu ezinokuthi zigubungele le ndawo;
- Izinto ezenziwa ngabatu, umz., ukuwa kwenqwelo-moya ngempazamo.

Imithetho ekhoyo ngoku ekufuneka kusetyenziswe yona xa kuphononongwa izinto ezenzekayo zangaphandle ngethuba kusenziwa uphando ngesiza ekuza kwakhiwa kuso iziphehli-nyukliya ezitsha icaciswe kula maxwebhu alandelayo mabini:

- I-R.388 (*Safety Standards and Regulatory Practices*); kunye
- Ne-R.927 (*Regulations on Licensing of Sites for New Nuclear Installations*).

Imigaqo eku-R.927 ebhekisa kwizinto ezenzeka ngaphandle yile:

> *“4(2) Isiphehli-nyukliya esicetywayo kunye neempawu zesiza ekuza kwakhiwa kuso: Isiphehli-nyukliya kufuneka kwakwindlela le siyilwe ngayo, kulwakhiwo kunye nendlela esiza kusebenza ngayo sibonakalise ukuba siza kuwaphungula kakhulu amathuba okuba ezi zinto zangaphandle kuthethwa ngazo zikhokelele ekubeni kuphume imitha enobungozi emininzi.”*
>
> *“4(3) Le ndawo sikuyo isiza kunye nobuxhaka-xhaka baso bokuqinisekisa ukhuseleko, eziqukwe njengamanyathelo okuthintela umonakalo oyingozi onokwenziwa zezi zinto zangaphandle kubhekiswa kuzo, kufuneka ziqinisekise ukuba mancinci kakhulu amathuba okuba luntu luchaphazeleke.”*
>
> *“4(4) Isiza kufuneka sime ngohlobo lokuba loo mitha inobungozi kunye nomngcipheko wengozi kwimisebenzi yesiqhelo kunye nezinto ezenzeka ngaphandle*

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ezinokuchaphazela iziphehli-nyukliya kulo mmandla mincinci ngokweqondo elimiselweyo."

"4(5) Kufuneka kwenziwe amalungiselelo okulalelisela iziganeko zendalo kunye nezinto eziyingozi ezenziwa ngabantu kwindlela esiyilwe ngayo isiphehli-nyukliya, futhi kufuneka kubhalwe nesicwangciso esinamalungiselelo exesha likaxakeka nawokhuseleko."

"5(3) Iimpawu zesiza ezihambelana nohlolo loyilo, ukubalwa kobungozi nomyinge wemitha enobungozi, kuquka, phakathi kwezinye:

a) izinto ezenzeka ngaphandle;

b) iinkcukacha ngemozulu;

c) ukusetyenziswa komhlaba;

d) inani labantu;

e) uphuhliso lwengingqi

"5(4) Uphando olunzulu olunika iinkcukacha ngazo zonke izinto ezinobungozi ezinokubangelwa sisiphehli-nyukliya ezinokuthi zichaphazele uluntu nokusingqongileyo. Uluhlu olungumzekelo onika iinkcukacha ngazo zonke izinto ezenzeka ngaphakathi nezenzeka ngaphandle ezinokuchaphazela esi siphehli-nyukliya (iziphehli-nyukliya) sitsha kufuneka lunikwe ingqwalasela."

6.3.2 Iingozi zeNdalo

Iziganeko ziphophononongwa ngokuthi kuhlalutywe iinkcukacha ezifunyenwe kwisiza nokuthi kujongwe indlela neenkcukacha-mani ezinikwa ulwazi ngokuxhaphaka kwazo. Ezi nkcukacha zinika ingcaciso ngamathuba okuba ingaphinda yenzeke into ethile nokuba amathuba okuba yenzeka kaninzi ngonyaka ngaphezu kwesiqhelo futhi umonakalo esiwenzayo ude ugqithise kulo uqhelekileyo futhi ulungiselelweyo.

6.3.2.1 Iingozi emathunjini omhlaba

Uphando ngejoloji kwisiza saseThyspunt lwaqhutywa kwisithuba esingaphezulu kweminyaka engama-25. Olu phando lwaluquka iinkcukacha ngendlela owakheke ngayo lo mhlaba, uphando ngobume bomhlaba phakathi elwandle nalapha ngaphandle, amaphulo ophando-nzulu ngexesha avela ngawo kunye nobudala bawo amatye akule ndawo (i-*geochronological analyses*), uphando lwe-*geomorphologyie*s, uphando lwe-*paleoseismology*, kunye ne-*geotechnical investigations.*

La maphulo ophando aqhutywa njengenxalenye yamaphulo ophando lokutshayelela lokuqala ngethuba kukhangelwa iziza ezahlukeneyo zokwakha iziko lokuphehla inyukliya, uphando olwalukhangela okuthile apha kwisiza saseThyspunt, kunye nophando lwejoloji olwaqhutywayo lusenzelwa kanye ukufumana iimpendulo ngowona umba ungundoqo weenyikima. Njengoko

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isikhokelo se-NNR sisitsho kunye nemigaqo nemigangatho esetyenziswayo kwihlabathi, iintlobo ezahlukeneyo kunye nezixhobo zasetyenziswa futhi nophando olwaluquka amanqanaba ahlukeneyo afuna ukuba amaphulo ahlukeneyo ophando anike iinkcukacha ezigcweleyo ngomba othile ocacileyo, imiba leyo iquka ummandla esikuwo isiza, izinto ezikufutshane naso isiza, ubukhulu besiza kunye nendawo esikuyo isiza. Njengoko kugqaliselwe kule mithetho ilawulayo ikhoyo, iziphumo zophando oluqhutyiwe ngesiza ziye zadityaniswa neziphumo zophando oluqhutywe zezinye iingcali kwicandelo lezejoloji zaze zapapashwa kwiincwadi zeengcali kweli candelo.

Into ezelwe kukudibanisa zonke iziphumo zophando olwenziweyo lwejoloji kunye nohlalutyo oluvela kwiingcali ezisebenza ngeencwadi zenzululwazi yejoloji lulwazi olunzulu nolugcweleyo lwejoloji yommandla esikuwo isiza, izinto ezikufutshane naso, ubukhulu baso kunye ndawo esikuyo.

Iyaziwa ijoloji yolwandle neyangaphandle elwandle ngokunjalo namathanda akuqweqwe lomhlaba ophantsi kolwandle nongaphandle yalo mmandla unesiza. Unxweme kunye nethafa elikufutshane nonxweme kule ndawo inesiza lubonisa ukuba le yindawo ekudala yabanje futhi nengatshintsha-tshintshiyo. Amatye amile emhlabeni abangela olu nxweme luzingxondorha anceda ukuthintela ukhukuliseko lomhlaba futhi abambe le ndawo yama nkqi ngolo hlobo yaba ikulungele kakhulu ukwakhiwa kweziko lokuphela inyukliya. Amathuba okuba kubekho utshintsho olukhulu kubume bale ndawo ambalwa kakhulu. Ngenxa yamatye aphantsi komhlaba ane-silica eninzi (i-sandstone ne-siltstone) enzeka nge-*Palaeozoic Era* ehleli kuwo le ndawo inesiza, akukho mngcipheki wokuba kugungxuke umhlaba uvule umngxuma phantsi kwesi siza.

1. Uzinzo lwethambeka

Isiza kunye nendawo esimelene nayo ziye zahlolwa kujongwa uzinzo lwethambeka (okufana nokudilika komhlaba namatye) okunokuthi kuchaphazela ukhuseleko lwesiphehli-nyukliya.

Ingxaki yokungazinzi kwethambeka yinto eyenzeka kwiindawo ezingamageduka, ezinamanzi amaninzi aphantsi komhlaba, okanye nokushuku-shukuma komhlaba okungenzeki ngenxa yokuba uvela iintanda. Ukungabikho kozinzo kwithambeka kungabangela ukudilika kweengqimba zomhlaba kunye notshintsho kumhlaba into enokubangela ukuba isiphehli-nyukliya singakhuseleki. Kungaphazamisa naxa kukho ingozi equbulisileyo.

Esi siza phantsi komhlaba sinedwala elihleli phezu kweentlobo zesanti ezibhudlwe ngumoya (i-Aeolian) ezishiyanayo ngobuninzi kwezinye iphakame kangange-0 m kumgangatho wolwandle ukanti ezinye zitshone kangange-65 m phantsi kweenkcochoyi zenduli zesanti (ezikumgama oyi-700 m ukusuka ulwandle).

Kukho amanzi asematyeni angekho ezantsi kakhulu phantsi komhlaba akumgangatho wolwandle nasezantsi ngomgama oyi-60 m kwiinkcochoyi zeenduli zesanti.

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Ingxaki yokungazinzi kwethambeka iza kuthathelwa ingqalelo kubuchule bobunjineli obufunekayo kwesi siza.

2. Ukugungxuka, ukudilika okanye ukukhukhumala komhlaba esikuwo isiza

Iinkcukacha zejoloji kunye nolunye ulwazi olufanelekileyo lalo mmandla zihloliwe kujongwa ukuba akukho zinto zendalo ezifana neendonga ezinzulu, iingxondorha kunye nezinto ezenziwe ngabantu ezifana nemigodi, iikwari kunye namadama. Uhloliwe nomba wamathuba okugungxuka, ukudilika nokukhukhumala komhlaba esikuwo isiza.

Esi siza sinamatye entlabathi (i-*sandstone*) angaphantsi aluhlobo lwe-*Table Mountain Group* afana kakhulu nala aseSkurwebeg (kufutshane nolwandle) nala aseGoudini (kude kakhulu kunolwandle. Olu hlobo lwamatye alunazimpawu kuwo ezinokuwabangela ukuba enze iintanda emhlabeni (umz., imiqolomba) nomqhokro (obangwa lilitye lekalika /i-*dolomite*). Ngethuba kusenziwa umsebenzi omkhulu wokubhola nokomba kwesi siza khange kuvele zintanda ezinokuthi zibe yingozi evela ngaphandle kwesi siza.

Ezi zinto zilandelayo zithathwa ngokuba ziyingozi kwiziko lokuphehla inyukliya:

- Iimpawu ezibonakalisa ukuba kungakho iintanda kunye nengxaki yomhlaba ogungxuka lula ngenxa yokuba kukho iindonga, izadunge, imiqolomba, imijelo ephantsi komhlaba, ingxaki yakudala yokugungxuka komhlaba, iibhulorho zendalo, izigingqi, imithombo, iintlobo zamatye ezifana ne-*limestone* (litye lekalika), i-*dolomite, gypsum, anhydrite, halite, terra rossa soils, lavas*, amatye aluhlobo lwe-*clastic* angomelelanga, amalahle okanye i-*ore*; kunye nezinto ezingafanelekanga kumatye anyibilikayo;
- Iindawo ezibonakalisa ukuchachamba nokungomeleli kumatye aluhlobo lwe-*crystalline*.

Ulwazi oluqokeleleweyo ukuza kuthi ga ngoku olusuka kumaphulo ophando anzulu angaphambili enziwe kwesi siza, lubonisa ukuba akukho zinto zikhoyo kule ndawo zinokubeka isiphehli-nyukliya emngciphekweni. Ukongeza, njengokuba isiphehli-nyukliya kulindeleke ukuba sime phezu kwelitye elilidwala, akulindelekanga ukuba kubekho ukugungxuka, ukudilika okanye ukukhukhumala komhlaba kule ndawo sisasebenza esi siphehli-nyukliya.

Imigodi ekumgama ongaphantsi kwe-16 km ukusuka kwesi siza nayo iye yanikwa ingqwalasela ukukhangela amathuba okuba ezi zinto zenziwa ngabantu zibeke esi siza emngciphekweni. Iziphumo zophando zibonise ukuba akukho migodi ikhoyo kumgama ongaphantsi kwe-16 km ukusuka kwesi siza enokuthi yenze umonakalo.

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Zikhona iikwari, iindawo zokwenza izitena nezokugrumba isanti ezimbalwa kulo mmandla sikuwo esi siza eziyinxalenye yecandelo lezokwakha kwaye ziqhubeka kufutshane nezi dolophi zikhoyo apho kukho amaphulo olwakhiwo amatsha amaninzi.

Amaphulo okugrunjwa kwemingxunya yokutsala amanzi kunye namadama kufuneka abe kufutshane kakhulu kwesi siza seziko lokuphehla inyukliya ukuze akwazi ukwenza umonakalo ngenxa yamanzi amancinci akhoyo phantsi komhlaba abonwe ngethuba kujongwa inzuzo yokwenza umsebenzi ofana nalowo obuqhutywa kwesi siza.

Akukho migodi ye-oli okanye gesi okanye amaphulo okuzingela izimbiwa kulo mmandla sikuwo esi siza.

Ngokolwazi olukhoyo ngoku ngesi siza kunye nalo mmandla, akukho ziganeko zokudilika, ukugungxuka okanye ukukhukhumala komhlaba okubangwe kukuvuleka kweentanda, imiqhokro, imigodi, imingxuma yokutsala amanzi okanye amadama e-oli aphantsi komhlaba, kulindelekileyo ukuba kwenzeka kuyo yonke le minyaka siza kube sisebenza esi siphehli-nyukliya.

3. Ukuzika komhlaba

Kuye kwenziwa uphando ngamathuba okuba kuvele ingxaki yokuzika komhlaba ongaphantsi kwesi siza kuza kwakhiwa kuso kusetyenziswa izixhobo zokwenza oku kujongwa uhlobo oluthile lokushukuma komhlaba. Olu hlobo lophando luquke ukusetyenziswa kweendlela ezamkelekileyo zokuphanda ngomhlaba nezokuhlalutya zokukhangela iingozi. Izakhiwo zingafumana umonakalo omkhulu ukuba zakhiwe kumhlaba ozikayo.

Esi siza sinamanzi ngaphantsi atsitsa ematyeni phantsi komhlaba kwindawo enesanti engekho mgangathweni eyi-*Aeolian* ebonisa umhlaba ompasalala kwiindawo ezithile. Kwiindawo eziphakame kakhulu kukho amathuba amaninzi okuba umhlaba uzike.

Ingxaki yokuzika komhlaba ingalungiswa ize ilungiselelwe kwakwindlela le sakhiwa ngayo isiphehli-nyukliya, umz., ngokuthi kwakhiwe umgangatho owomeleleyo ngekhonkolo phezu kwelitye eliphantsi komhlaba.

4. Ukugqabhuka kwentaba-mlilo

Intaba-mlilo ingalibeka engozini iziko lokuphehla inyukliya ngethuba lisasebenza. Ngokomthetho wazo, iintaba-mlilo ezikhe zagqabhuka kule minyaka ingama-10 000 idlulileyo zithathwa ngokuba zisenokuphinda zigqabhuke, zisalele ngokwangoku. Ulwazi olufunyenwe kwiziphumo zophando lubonakalisa ukuba intaba-mlilo eyakhe yagqabhuka kulo mmandla unesiza yagqibela kwisithuba seminyaka engaphezulu kwezigidi ezili-10 eyadlulayo into leyo ethetha ukuba ngokwangoku ayinakuphinda igqabhuke okanye idubule.

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5. Iintlobo zamatye okubeka isiseko sesiza

Lwenziwe uphando malunga nobume bomhlaba ongaphantsi, kuquka nezinye izinto ezingaqondakaliyo ngawo, oluthe lafumanisa ukuba lo mhlaba ukulungele ukumelana neziko lokuphehla inyukliya elikumila kunje. Indawo le sibekwe kuyo isiphehli-nyukliya nayo iqinisekisiwe ukuba yomelele kwaye ingakwazi ukumelana nezinto ezifana neenyikima. Amanzi asemathunjini omhlaba nawo ahlolwe kujongwa iikhemikhali anazo.

Uphando olubanzi olwenziweyo ngamatye alidwala eliphantsi komhlaba kule ndawo inesiza kusetyenziswa uphando oluqhutyelwe apha kule ndawo noluqhutywe elebhu lubonakalise ukuba esi siza sihleli phezu kwelitye elomeleleyo eliyi-*quartz* (elinelitye lentlabathi elininzi) eluluhlobo lelitye laseSkurweberg kweli cala lisemazantsi kunye nelinye elomeleleyo eluluhlobo lwala aseGoudini (nalo elilitye lentlabathi eline-*quartz*) embindini nakumantla esi siza.

La matye akhuhleke kakhulu aze aqhuzuka ngenxa yokuxikixwa kukukhuhlana kwamaceba oqweqwe lomhlaba kwaye nesiza sikweliqolo lisemazantsi lethambeka. Amatye aluhlobo lwe-*Table Mountain Group* aphantsi kwesi siza akwicala elimalunga ne-50° ngasezantsi. Ngenxa yokuba la esukela kuhlobo lwamatye enziwe ngentlenga, atyeke ngeendlela ezahlukene kakhulu kuba le ndlela atyeke ngayo ixhomekeka kwintlenga kunye nokuma kokuqhezuka kwamatye.

Amatye aluhlobo lwes-*Skurweberg* neGoudini abonakala njengamatye ahlukileyo ngokomelela, i-*uniaxial comprehensive strength* (i-UCS). Ngamafutshane, amatye aluhlobo lwaseSkurweberg omelele kakhulu ngokwe-UCS xa ethelekiswa nala aluhlobo lwaseGoudini. Ukomelela kwamatye ase-Skurweberg ngokwe-UCS kungaphezulu kukomelela kwamatye ase-Goudini ngokwe-UCS.

Ngethuba kuthelekiswa uhlobo lomhlaba olufunekayo xa kuza kwakhiwa isiseko sokubeka iziko lokuphehla inyukliya kunye nolu lwazi lukhoyo ngoku kubonakele ukuba akukho zinto zinokuthintela ukwakhiwa kwesiseko ekuza kubekwa kuso iziko lokuphehla inyukliya kula matya alidwala esimi kulo esi siza.

6.3.2.2 Ingozi yeenyikima nokutshintsha kwesimo somhlaba

Ngethuba kuqhutywa uphando ngobunzulu beenyikima, i-*probabilistic seismic hard analyisis* (PSHA) eThyspunt, i-USNRC iye yayivuma inkqubo ye-*Senior Seismic Hazard Analysis Committee (SSHAC) Level 3* eyathi yalandelwa ukuze kunikwe isiqinisekiso esiqinisekisisisweyo sokuba izinto ezingaqondakaliyo zikhangelwe futhi zachazwa. Kwenziwe konke ukuqinisekisa ukuba olu phando ngeengozi zonke iinkcukakacha zeengxelo zibhalwa phantsi, futhi zihlolwe zingcungela ukuqinisekisa ukuba akukho nto ibethwe ngoyaba.

Ulwazi olunzulu ngeenyikima lulo olusetyenziswayo xa kuqikelelwa ukuba ziza kuphinda zenzeke nini ezinye iinyikima, ezi zizo ezibangela ingozi enkulu. Ngelishwa ulwazi olukhoyo oluthathwe ngokusebenzisa ubuxhaka-xhaka bale mihla alulandi liye emva kakhulu futhi nalapha eMzantsi

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Afrika zimbalwa kwaye ziqelelene iindawo ezinobuxhaka-xhaka bokumamela nokujonga iinyikima. Ukuze sikwazi ukwandisa ulwazi olukhoyo ngeenyikima, kuye kwenziwe uphando koovimba bolwazi nakumaphepha-ndaba (kukhangelwa iingxelo nobungqina bokuba zange zenzeke ngenene) ngeenjongo zokuqinisekisa ukuba le nto yokungabikho kobungqina beenyikima ingaba ithetha ukuba azikho ngenene na kulo mmandla ume isiza. Amaphulo ophando ngeenyikima zangaphambili aye ancediswa nalulwazi olutyebileyo ngeenyikima eziye zamanyelwa zihlolwa ngobuxhaka-xhaka bale mihla, ebezisetyenziselwa ukujonga ezi ndawo kuthiwa zifanele ukuba zineenyikima (nomonakalo wazo) ukuba ingaba olo lwazi luyahambelana na xa kujongwa kwiindawo ezazenzeke kuzo iinyikima ngaphambili (nomonakalo wazo).

Emva kokuba eqinisekisiwe amaceba oqweqwe lomhlaba nawobume bomhlaba wamazantsi oMzantsi Afrika, kuye kwaqhutywa uphando kukhangelwa konke okukhe kwenzeka kutsha nje kubume bomhlaba kwezi ndawo zaziwayo zithandwa zinyikima nezinye izinto zokushukuma komhlaba. La maphulo ophando ebegxininisa kakhulu kwimimandla ethandwa zintshukumo zomhlaba, ingakumbi kummandla waseKango onethanda elithe laqalisa ukwenza intshukumo kwakhona ngeli xesha le-*Quaternary*, apho kuvuleke umsele. Uphando ngeendonga eziselwandle lucacisile ukuba akukho ntshukumo yenzeka kwithanda elisemhlabeni neliselwandle. Ngenxa yokuba kungekho zinkcukacha zibanzi futhi ziqinisekisiweyo ngeenyikima eMzantsi Afrika, kuye kwasetyenziswa ubuxhaka-xhaka obungenamandla kunye nolwazi ukuze kubonwe ukuba iintshukumo emathunjini omhlaba zinjani kwaye zinzulu kangakanani na kulo mmandla. Akukho zinkcukacha zipapashiweyo ngoqikelelo lweentshukumo emathunjini omhlaba (ii-GMPE) oMzantsi Afrika, kodwa kwenziwe iinzame zokuba kukhethwe ii-GMPE ezinobuxhaka-xhaka bale mihla kwesi sicelo kwaze kwenziwa uhlenga-hlengiso kwezinye iinkcukaca ukuzenza zihambelana nokwenzekayo kwisiza nakulo mmandla.

Wenziwe umsebenzi wokubala nokulinganisa isantya samaza esi siza saseThyspunt. Iinkcukacha ezigcweleyo ziye zaqokelelwa kulungiselelwa i-Thyspunt PSHA zaze zahlalutywa zicokisiswa. Ulwazi olubanzi nalo luye lwafunyanwa ngokubamba iindibano ezihleliweyo neengcali ezinolwazi nezixhasa lo msebenzi ngethuba kubanjwe iindibano zocweyo eziqhutywe ngokwengcaciso enikwe kwiinkqubo ze-SSHAC Level 3. Iqela lokuhlaziya kuthathwa inxaxheba (i-PPRP), elenziwe zingcali ezaziwayo kwihlabathi jikele, liye latyunjwa, laze laphonononga zombini ezi nkqubo zilandelweyo kunye nolwazi lweengcali ngeenkqubo ezisetyenzisweyo ukuqikelela ingozi, isebenzisana neprojekthi izihlandlo ezininzi futhi liqhuba uphononongo olungashiyeleli nto kuxwebhu oluye lwapapashwa. I-PPRP ivakalise ukwaneliseka ukuba inkqubo ye-SSHAC Level 3 ilandelwe kuwo wonke lo msebenzi nokuba uhlolo lokugqibela olujonga ingozi liyazifezekisa zonke izinto ezifunwayo, kuquka zonke iinkcukacha zezinto ezifunekayo nezamkelekileyo (into ekuthiwa ngolwasemzinzi yi-*Centre, Body, and Range" ye-"Technically Defensible Interpretations*).

1. Uhlalutyo lobungozi obunxulumene neenyikima

Eyona nto iyingozi kakhulu kwesi siza kukwenzeka kwenyikima, ukushukuma komhlaba nokutshintsha kobume bomhlaba. I-PSHA iqhutyiweyo kusetyenziswa iinkqubo

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ezisetyenziswa kwihlabathi liphela. I-PSHA inika ingcaciso ngezinto ezingaqhelekanga nekungaqinisekwanga ngazo ezinxulumene nokuhla kwengozi yeenyikima.

Ulwazi olufunywe yi-PSHA luquka umfuziselo okhangela intsusa yenyikima kunye nowokunika ingcaciso ngesizathu sokushukuma komhlaba (i-GMC). Umfuziselo wokukhangela intsusa yenyikima uchaza indawo kunye nezihlandlo eziza kwenzeka ngayo iinyikima ezingekenzeki ezohlukeneyo ngobukhulu nobunzulu kwaye usebenzisa ulwazi oluqokelelwe lwaze lwabhalwa phantsi ngeenyikima ezazenzeke mandulo kungekabhalwa izinto phantsi, ezanzeke kudala kunye nezo kwathathwa iinkcukacha ngobuxhaka-xhaka bokwenza lo msebenzi zazenzeke kulo mmandla. Umfuziselo we-GMC wenza uqikelelo ngesantya senyikima xa silinganiswa size sibalwe kwindawo ethile.

Intshukumo eyenzeka emhlabeni esukela kuzo zonke iintlobo zenyikima ezinokwenzeka ziye zabalwa kwaze ngokusetyenziswa kwesampuli kwafunyanwa iinkcukacha ngayo yonke intshukumo eyenzeka emhlabeni eqikelelwayo yezinga inqanaba ngalinye lokunyuka kwesantya ekulindeleke ukuba ligqithise kwisiza. I-GMRS iye yabonwa eyinto esetyenziswa njengesiseko xa kusakhiwa isiphehli-nyukliya esiza kukwazi ukumelana neenyikima kule ndawo.

I-GMRS yaseThyspunt ibonisa ukuba iThyspunt ikwindawo engenazinyikima zininzi. Indlela emi ngayo i-GMRS yaseThyspunt iyafana neyeza ndawo zinamatye aqinileyo ziseMpuma yeMelika.

Into ebangela ukuba indlela eyakhiwe ngayo iThyspunt, nangona kusetyenziswa olwazi olugxininise kumyinge nezihlandlo zokuxhaphaka kweenyikima neziquke nezinye izinto ezingenakufane zenzeke ngokolwazi olufunywe ezincwadini nakuphando kuba akukho ndawo ikufutshane neThyspunt eyakhe yahlaselwa yinyikima ezimbalini.

2. Ukuvuleka kweentanda emhlabeni

Ajongiwe namathuba okuvela kwengxaki yokuvuleka kweentanda emhlabeni eThyspunt. Iindlela ezisetyenzisiweyo kunye namaphulo ophando enziweyo acacise ngokuphandle ukuba ambalwa kakhulu amathuba okuba kuvuleke iintanda emhlabeni eThyspunt. Uphando luchaza ukuba akukho bungqina bokuba kungakho utshintsho kwiceba loqweqwe lomhlaba kule ndawo simi kuyo esi siza nokuba mancinci kakhulu amathuba okuba oku kwenzeke. Oku kusekelwe kuphando lwezejoloji olubonise ukuba ezi ntanda zaziwayo kulo mmandla sikuwo isiza azinakukhula zenze umonakalo. Uphando ngamatye aphantsi komhlaba kule ndawo inesiza lubonisa ukuba akukho bungqina bokuba kungavuleka iintanda emhlabeni into eza kubonisa ukuba kukho ithanda eliza kuvela. Esi sigqibo sisekelwe kumba wokuba akukho zinto zingaqhelekanga kubume bomhlaba, ezibonisa ukuba kukho utshintsho oluza kwenzeka kulo mhlaba olubangelwa leli xesha le-*Quaternary*.

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6.3.2.3 Iziganeko zemozulu

Lwenziwe uphando ngemozulu yangoku neyelixa elizayo yalo mmandla ungqonge esi siza lwaze lwahlalutywa ngeenjongo zokukhangela izinto ezivela ngaphandle kwesiphehli-nyukliya ezinokuba nobungozi kuso. Kudalwe ne-atmosfera efunekayo eza kukwazi ukuhambelana noqikelelo oluyimfuneko olwenziwayo ngendlela i-atmosfera esasaza ngayo izinto ezingumoya ukulungisela ingozi enokwenziwa yimitha enobungozi kuluntu nakosingqongileyo futhi nesicwangciso somhla kaxakeka senziwe. Njengoko imithetho yehlabathi neyalapha ekhaya icebisa, iziganeko ezibini ezingundoqo ezinxulumene nemozulu ekufuneka zithathelwe ingqalelo ngethuba kusekwinqanaba lokuhlola, oko kukuthi, amalungiselelo emozulu enobungozi kakhulu kunye namalungiselelo eentlobo zemozulu ezinqabe kakhulu.

Ukuze kuhlolwe amalungiselelo enziweyo eentlobo zemozulu eziyingozi kakhulu, kuye kwaphandwa ezi ntlobo zemozulu zilandelayo: umoya omkhulu wenkanyamba (kuquka nezaqhwithi ezikhulu zothuli), iziphango, isichotho (kuquka namahamba-namvula), iqondo lobushushu lomoya (ibhalbhu eyomileyo nebhalbhu emanzi), unxinzelelo lomoya, kunye nokwanda kwezaqhwithi. Izinto ezingaqondakaliyo kolu lwazi kunye nezinye izinto ezinokuza noguqu-guquko lwemozulu ziye zathathelwa ingqalelo ngethuba kusenziwa uhlolo.

1. **Ukulinganiswa kwemozulu**

   Ulwazi lwemozulu olukhoyo loluqokelelwe kule ndawo isithuba seminyaka emithathu. Ulwazi oluqokelelwe isithuba eside lulo olusetyenziswayo xa kusenziwe uhlalutyo lwexesha elide. Ukuze sikwazi ukubona konke okwakwenzeke ngaphambili, i-NNR kunye ne-IAEA ziyakuvumela ukuba kusetyenziswe ulwazi lwezemozulu kumaziko emozulu akufutshane. Njengoko imozulu yaseCape St. Francis ifana nemozulu yale ndawo inesiza, ke ngoko ulwazi ngesi siza longezwe ngolwazi lwemozulu lwexesha elide oluqokelelwe liziko lemozulu le-*South African Weather Service* (i-SAWS) eCape St. Francis, ekumgama omalunga ne-12 km ngasempuma yesi siza. Ulwazi lwexesha elide (lweminyaka engama-30 nangaphezulu) lona luthathwe kumaziko emozulu eHumansdorp naseBhayi, indawo ezo zona zithe qelele.

   Iziko lemozulu elilapha kule ndawo inesiza linepali eyi-10 m ubude, ubuxhaka-xhaka obunazo zonke izinto ezifunekayo bokuqokelela lonke ulwazi olufunekayo. Kusetyenziswa umatshini ozifakela ngokwawo ulwazi ukuthatha iinkcukacha zemozulu. Olu lwazi luyakwazi ukufunyanwwa umntu engekho ngokuthi kusetyenziswe umnxeba one-*modem* okanye lukhutshelwe kwikhompyutha umntu elapha kuso, esebenzisa intambo yokukhuphela ulwazi lwekhompyutha kunye nekhompyutha yakhe.

   Uthathiwe umlingeniselo wekhemikhali ebangela umhlwa kumoya walapha kusetyenziswa i-*coupon-based method* (i-CLIMAT) kunye ne-*ISO Standard 9223*. I-CLIMAT yona isetyenziswa ngokuba kubekwe amacwecwana esinyithi phandle kuze kuqwalaselwe uhlobo lomhlwa oza kuvela uchazwe ukuba uluhlobo luni na. I-*ISO Standard 9223* yona yenza umlinganiselo weqondo lobushushu kunye nokufuma

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okukhoyo kwiziko lemozulu elikufutshane kunye nomyinge we-*sulphur dioxide* ekhoyo emoyeni kunye netyuwa esemoyeni ukuze kubalwe izinga lokukhula komhlwa.

Iphulo lokuqhuba uphando olukwinqanaba eliphezulu ngemozulu luza kuqhutywa kwisithuba sonyaka phambi kokwakhiwa kweziko lokuphehla inyukliya.

2. Imilinganiselo yemozulu

i) Isantya somoya nocala obheka ngakulo

Ulwazi lwakudala olwaqokelelwa ngu-Eskom (ngo-1987 ukuya ku-1988) luchaza ukuba elona cala uthanda ukuvela ngakulo umoya kulo mmandla unesiza kusentshona yomntla-ntshona uye ngasemntla-ntshona. Yingxelo zithi imimoya emikhulu emininzi yayisuka ngasentshona mntla-ntshona isiya kwicala lasemntla-ntshona.

Uphando olwenzelwa kule ndawo iphandwayo ukusuka ngo-2008 ukuya ku-2011, imimoya eya ngasentshona yiyo ibimininzi kangangoku yenzeke izihlandlo ezimalunga nama-20,88%. Imimoya eya ngasentshona ibithanda ukuba nemimoya emikhulu (eyi-0,33% ibiyi-12 m/s). Imimoya ekwindawo yesibini ngokuxhapha ebithanda ukuba mikhulu (0,30%) isuka ngasempuma, ize ilandelwe yesuka ngasentshona yomzantsi-ntshona (0,19%) emva kwayo yevela ngasempuma yomntla-mpuma (0,71%).

Ehlotyeni kukho imimoya emininzi esuka ngasentshona nesuka ngasempuma eCape St. Francis xa kuthelekiswa naseThyspunt. Kukho imimoya emininzi kakhulu esuka ngasempuma yomntla-mpuma nasentshona yomntla-ntshona eThyspunt kunaseCape St. Francis.

Elona nani liphezulu lingumyinge lemimoya emikhulu esezincwadini eThyspunt ukusuka ku-2008 ukuya ku-2011 libhalwe kuTheyibhile 3 ngezantsi. Uninzi lwemimoya emikhulu isuka ngasentshona ize ilandelwe yesuka ngasempuma yomntla-mpuma.

ITheyibhile 3: Umlinganiselo weyure womyinge womoya wenyana kunye nesantya somoya (m/s) eCape St. Francis naseThyspunt

Inyanga	Cape St. Francis (Juni 2004 – Matshi 2011)		Thyspunt (Janyuwari 2008 – Matshi 2011)	
	Umyinge	Ongowona umkhulu	Umyinge	Ongowona umkhulu
Janyuwari	16,7	24,0	14,2	22,8
Februwari	16,4	25,0	13,5	30,7
Matshi	19,5	28,0	13,5	22,9

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Inyanga	Cape St. Francis (Juni 2004 – Matshi 2011)		Thyspunt (Janyuwari 2008 – Matshi 2011)	
	Umyinge	Ongowona umkhulu	Umyinge	Ongowona umkhulu
Apreli	16,4	24,9	14,1	22,4
Meyi	19,5	33,7	15,1	31,6
Juni	23,2	36,4	17,9	28,4
Julayi	19,9	34,2	18,2	24,6
Agasti	21,1	35,3	16,4	27,6
Septemba	18,8	29,9	14,9	30,6
Okthobha	18,5	27,7	17,9	30,4
Novemba	16,2	24,3	13,8	23,4
Disemba	19,7	28,9	16,6	24,2
Annual	23,2	36,4	18,2	31,6

ii) Amaqondo obushushu omoya aphakathi

Iqondo lobushushu eliphezulu elixhaphakileyo eThyspunt ibingu-20,9°C lona elaseCape St. Francis ingu-19,6°C. Elona qondo lobushushu lisezantsi lixhaphakileyo eThyspunt ibingu-14,9° lize elaseCape St. Francis ibe ngu-14,5°C.

Elona qondo lobushushu lalitshisa kakhulu xa libalwa ngeyure kwisithuba esisuka ku-1920 ukuya ku-1984 lalingomhla wesi-2 Janyuwari 1963 (yayingu-42,8°C) laze elona libanda kakhulu langomhla wesi-3 Meyi 1943 (yayingu-0,8°C). La maqondo obushushu abaxekileyo khange abonwe phakathi kuka-2004 no-2011 (ibingu-37,2°C ngomhla we-19 Matshi 2008 kunye no-5,0°C ngomhla we-19 Agasti 2005) okanye eThyspunt (ibingu-38,2°C ngomhla we-13 Apreli 2010 no-6,7°C ngomhla wama-20 Agasti 2010).

iii) Isichotho

Imvula inetha unyaka wonke kulo mmandla unesiza. Umyinge wemvula wonyaka (i-MAP) kulindeleke ukuba ube phakathi kwe-600 mm kunye ne-800 mm. Uphando obelisikelwe iminyaka emithathu (ukusuka ngo-2008 ukuya ku-2011) eThyspunt lubonise i-589,6 mm, oko kuthi i-515,3 mm inethe ngo-2008, i-595,1 mm yanetha ngo-2009 yaze i-657,3 yana ngo-2010.

Uphando lwexesha elide olwenziwa kwiziko lemozulu le-SAWS eliseCape St. Francis olusuka ngo-1878 ukuya ku-2001 labonisa ukuba umyinge wemvula enileyo yi-664 mm. I-MAP ibale imvula ka-2005 ukuya ku-2010, ayamfaka u-2008, kwiziko lemozulu elitsha elakhiwe eCape St. Francis ngo-2004 yaze yakhupha u-530,2 mm.

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Kuye kwathelekiswa iziphumo zophando lweminyaka emithathu oluqhutywe eThyspunt nolu lwexesha elide luqhutywe eCape St. Francis.

Imvula eqhelekileyo yenyanga inetha ngohlobo olunye unyaka wonke:

- Eyona mvula ininzi ena u-75 mm ingo-Agasti ize ilandelwe yengu-72 mm yona ena ngoMeyi
- Eyona mvula incinci ina i-32 mm ngoJanyuwari

Eyona mvula inkulu yakhe yana ngenyanga yayine yayingu-366 mm inetha ngoSeptemba ka-1932, eyona yakhe yana kancinci yayi-0 mm ngoJanyuwari ka-1906 noJuni ka-1949.

Eyona mvula yakha yana kakhulu ubusuku nemini eCape St. Francis (kwela ziko lidala lemozulu) yayiyi-130 mm ngomhla wama-27 Meyi 1944, ilandelwe yeyi-120 mm ngomhla wama-25 Matshi 1981. Eyona ke ngoku isezimbalini yakha yana imini nobusuku (iiuye ezingama-24) yi-157 mm eyana ngomhla wesi-5 Matshi 2007 kwiziko elitsha le-SAWS. Eyona mvula yakhe yana kakhulu ngeyure yayiyi-35,4 mm nayo yanetha kwangalo mhla mnye. Eyona mvula yakha yana kakhulu ngeyure eThyspunt yayiyi-51,9 mm ngomhla we-17 Matshi 2011.

iv) Iindudumo, isichotho, ikhephu nenkungu

Ulwazi lwemozulu oluthathwa e-SAWS yaseCape St. Francis (1881 – 1984) lalisetyenziswa ukubala umyinge wenani leentsuku ebezineendudumo, isichotho, ikhephu nenkungu. Iziphumo zolu hlalutyo nazi kwiTheyibhile 4.

ITheyibhile 4: Inani lentsuku ezineendudumo, isichotho, ikhephu kunye nenkungu eCape St. Francis (1881-1984)

Inyanga	Iindudumo	Isichotho	Ikhephu	Inkungu
Janyuwari	0,6	0,0	0,0	2,0
Februwari	0,7	0,0	0,0	4,0
Matshi	1,0	0,0	0,0	4,8
Apreli	0,8	0,0	0,0	2,8
Meyi	0,7	0,2	0,0	1,1
Juni	0,3	0,1	0,0	0,2
Julayi	0,3	0,2	0,0	0,5
Agasti	0,4	0,2	0,0	0,8
Septemba	0,5	0,0	0,0	1,0
Okthobha	0,8	0,1	0,0	2,4
Novemba	0,6	0,0	0,0	2,1
Disemba	0,5	0,0	0,0	2,6

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Ngonyaka	7,2	0,8	0,0	24,3

v) Umfumo we-atmosfera

Wenziwe umsebenzi wokuthatha umlinganiselo womfumo wexesha eliphakathi kukaJanyuwari 2008 noMatshi 2011 eThyspunt.

EThyspunt, elona nani liphezulu lomfumo ngosuku ngu-84,9% ongoJanyuwari lize lilandelwe lelingaphantsana kancinci kweli ngoFebruwari (elingu-84.5%). Eyona mini yayinomfumo kakhulu ngokweziko laseCape St. Francisi yayingoJanyuwari ingu-84.4% kunye nangoFebruwari ingu-85,1%.

Elona nani liphantsi lomfumo wosuku eThyspunt ingoJulayi (69,9%) ilandelwe nguJuni (72,3%). Umyinge wonyaka welona nani liphezulu lakhe lakho ngu-94,6% lase lona elilona liphantsi langu-55,9%.

Ukufuma okungumyinge wonyaka onguwona uphezulu eCape St. Francis ngu-91.4% uze onguwona usezantsi ube ngu-62,3%.

vi) Uzinzo lwe-atmosfera

Imimandla esemazantsi nesentshona inomoya obandayo owehlayo orhuqa phantsi, obizwa ngokuba ngumoya wehewu, undanda kwindawo engu-500 m uze xa uhle kakhulu ube ku-600 m. Lo moya ubangelwa ngomoya ojikelezayo obandayo osuka phezulu (i-HP) woMzantsi Atlantic, futhi ungumda phakathi komoya owomileyo, ozolileyo osuka phezulu kunye nempepho yomoya ofumileyo waselwandle. Le ngubo yomoya ikumgangatho omnye nempepho yomoya wolwandle kunye nalo uhlayo usuka phezulu. Iqondo lobushushu lomoya ohlayo usuka phezulu liyatshintsha kodwa liqhele ukuba phakathi kuka-7°C ehlotyeni no-5,2°C ebusika. Lo moya uhlayo wehewu elisemazantsi mkhulu futhi uxhaphakile ehlotyeni (51%) ngenxa ye-HP yoMzantsi Atlantic uze ufikelele kwicala lasempuma ngoDisemba. Le nto yokunyuka komoya obandayo usuka emhlabeni yenzeka izihlandlo ezimalunga ne-30% ngeenyanga zasebusika. Oku kwenzeka ebusuku izihlandlo eziyi-50% ukuya ku-60% ngonyaka, kwaye kuxhaphake kakhulu ebusika kuba kwenzeka izihlandlo eziyi-70%.

Imozulu eqhelekileyo nexhaphakileyo kule ndawo yezolileyo (ukuzola okudidi luka-D), ize ilandelwe yimeko engazolanga (ukuzola okudidi luka-C).

The southern and western coastal areas experience a persistent low-level.

3. Imozulu embi nenqabileyo

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Imozulu enqabileyo luhlobo lwemozulu engenzeki rhoqo. Yiyo loo nto kumaziko emozulu, izixhobo ezisetyenziswa rhoqo ukuqikelela imozulu yesiqhelo zingakwazi ukuyibona ziyichaze kakuhle imozulu embi nengaqhelekanga. Imozulu embi nengaqhelekanga, ekunzima kakhulu ukuyiqikelela, uqikelelo lwayo lwenziwa ngokujonga inqanaba neqondo layo lobubi. La manqanaba achazwa ngokujonga iimpawu zomgangatho wayo ezifana nomonakalo enokuwenza okanye ngokomthamo obambekaya ofana nesantya somoya.

i) Imozulu embi

Unxweme olusemazantsi loMzantsi Afrika lwenziwa uqikelelo ngokuthi kusetyenziswe ubuxhaka-xhaka obujonga imozulu kwindawo enkulu eyiyo ebangela iintlobo zemozulu ezahlukeneyo kweli. Imozulu yeli kumaxa amaninzi ichazwa njengexhomekeke kumafu asemazantsi hayi la aphezulu azingqimba eza nezichotho kunye neentshizana ezineendudumo. Imozulu embi kakhulu ihambelana nemozulu enomoya omkhulu. Izinto ezine eziphambili ezibangela umoya zezi: umoya wonxweme orhubuluzayo, umoya osuka emazantsi ojikeleza ndawonye uvalelekile, umoya ongephi osuka emzantsi-mpuma, kunye nomoya wamazantsi oMhlaba.

Esi siza singahlaselwa yimozulu embi kakhulu ezindudumo, isichotho, inkanyamba enomoya omkhulu ovela elwandle, kunye nenkanyamba. Imozulu embi eMpuma Koloni iza ngeentlobo ezininzi ezixakisayo ngamanye amaxesha iba sisichotho esikhatshwa ngumoya, inkanyamba, imibane kunye nezikhukhula ezikhawulezileyo. Imimoya emikhulu kakhulu neyenza umonakalo eneendudumo ezigqekrezayo iquka iinkanyamba, izitshingitshane (ezo zibanzi nezo zincinci), imimoya emikhulu ekhapha iindudumo, isivunduvundu somoya [1].

ii) Iinkanyamba zommandla wetropikhi

Lwenziwe uphando ngamathuba okuba lo mmandla unesiza uhlaselwe zinkanyama zommandla wetropikhi. Ummandla waseThyspunt awunazinkanyamba okanye awumelananga nolwandle olunamanzi ashushu. Ke ngoko akulindelekanga ukuba esi siza sihlaselwe yinkanyamba, okanye singathi mancinci kakhulu amathuba okuba sihlaselwe yinkanyamba. Iinkanyamba zommandla wetropikhi zenzeka kwimimandla enamanzi olwandle aneqondo lobushushu elingaphezulu ku-27°C neziphakathi kuka-5°S no-30°S

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kumgca welathityudi. Esi siza siku-34°S ke ngoko asinakuhlaselwa zinkanyama zommandla wetrophikhi.

iii) Iinkanyamba ezisisaqhwithi

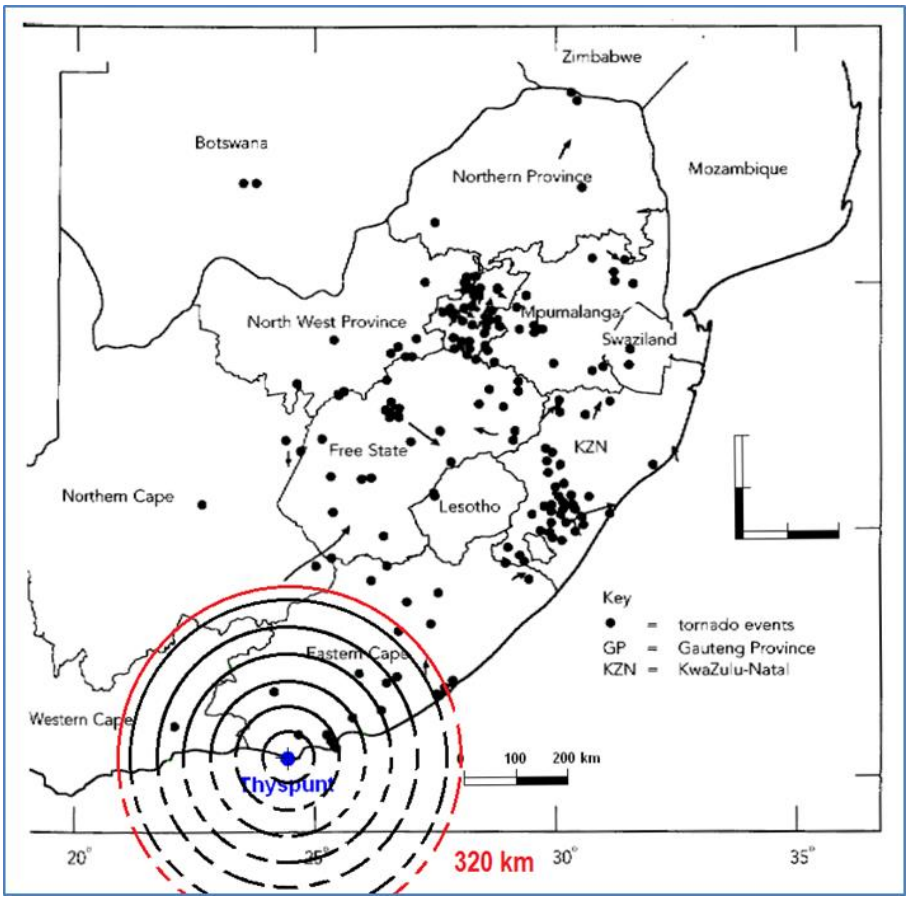
Inkanyamba ngumoya omkhulu kakhulu osiphula izinto ojikelezayo ongumphongolo osukelwa kwiindudumo. Lwenziwe uphando ngamathuba okuba iThyspunt ihlaselwe yinkanyamba kusetyenziswa ulwazi lwalo mmandla oluneenkcukacha ezanelyo lwakudala kunye nolo lushicilelwe ngoomatshini. Izinto eziyingozi eziza neenkanyamba ziphandiwe zaze zahlelwa ngokwemilinganiselo efana nesantya sokujikeleza somoya, isantya sokuhamba komoya, umgama onguwona mkhulu othathwa ngumoya ojikelezayo, umahluko phakathi komoya ovela ezantsi novela phezulu kunye nezinga lokutshintsha kwezi ntlobo zomoya. Xa kujongwa ubungozi, izinto eziyingozi ezisitshulwa yinkanyamba neminye imimoya emikhulu ziza kuthathelwa ingqalelo.

Zithathu izihlandlo apho kwakhe kwakho inkanyamba eBhayi (16 Matshi 1956, 10 Okthobha 1978 nange-2 Novemba 2000), kodwa akukho bungqina buthi kwakhe kwakho inkanyamba eThyspunt nakwiindawo eziyingqongileyo. Ngokujonga ezi nkanyamba zakhe zenzeka kuye kwenziwe uqikelelo ngokuxhaphaka kweenkanyamba kule ndawo inesiza ngokuthi kuphononongwe ezi ngxelo zikhoyo ngeenkanyamba. Oku kuquka neenkanyamba ezanzeke kwindawo ekumgama omalunga ne-320 km ukusuka eThyspunt (loo ndawo kuseMonti). UMfanekiso 17 unika iinkcukacha ngeenkanyamba ezakhe zahlasela phakathi kuka-1905 no-1997.

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UMfanekiso 15: Iindawo ezakhe zahlaselwa yinkanyama kwimimandla esempuma yoMzantsi Afrika ukusuka ngo-1905 ukuya kutsho ku-1997

iv) Umbane wezulu

Uphandiwe umba wamathuba okuba kubekho umbane wezulu kunye nombane omenyeza ngamandla kunye namathuba okuba oku kuphazamisa iintambo zombane zesi siza. Iinkcukacha ezikhoyo zibonisa ukuba umgama oyi-km^2 ubethwa ngombane isihlandlo esinye ngonyaka. Elona qondo liphezulu lokutshisa kombane elaziwayo ngu-166 kA (kiloampere) umyinge wawo ngu-15 kA

v) Izinto eziyingozi ezibhabha nomoya

Imozulu ebalulekileyo yileyo ibangela ukuba kusiphuke izinto eziyingozi zibhabhe nomoya zize zibethe isakhiwo, ubuxhaka-xhaka okanye iintsimbi zokubuxhaka-xhaka.

Imimoya emikhulu ehamba ngesantya esingaphezulu ku-34 m/s iyakwazi ukurhugula yonke into isiphule nezinye eziyingozi esendleleni yayo kunye

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nobugoxo obusuka kwizakhiwo ezikufutshane ihambe nazo. Isantya esiqikelelweyo somoya osisaqhwithi esijikelezayo senkanyama eyi-10^{-7}/a ngu-90 m/s. Ubuchule obusetyenziswayo xa kulungiselelwa izinto eziyingozi eziphapha nomoya busekelwe kuhlobo lomoya onesona santya siphezulu esabekwa yi-USNRC, esinika ingcaciso ngobu buchule nangesona santya siphezulu somoya ngolu hlobo:

- Umbhobho ongushedyuli 40
  - ubukhulu: 0,168 m ubukhulu besangqa, 4,58 m ubude;
  - ubunzima: 130 kg
  - esona santya siphezulu somoya ohamba ngokuxwesa: 34 m/s
- isithuthi:
  - ubukhulu: 5,0 m x 2,0 m x 1,3 m;
  - ubunzima: 1 810 kg
  - isantya sokuhamba phantsi: 34 m/s
- Into eqinileyo yesinyithi
  - ubukhulu: 0,025 4 m isangqa
  - ubunzima: 0,0669 kg;
  - esona santya siphezulu phantsi: 7 m/s

4. Ezinye iintlobo zemozulu ezimbi kakhulu

Iintlobo zemozulu ezimbi ezifana neenkanyamba zetrophikhi, umkhenkce nokugqunywa ngumkhenkce, uqhwithela olunekhephu kuye nembalela azibalwanga ngenxa yezi nkcukacha ngemozulu zinikwe ngasentla nokuba ulwandle lona ngokwalo lutsala ubushushu luze lubutheze amandla. Mancinci amathuba okuba kubekho umkhenkce elwandle kule ndawo inesiza.

Umonakalo onokwenziwa yisanti ebhudlwa ngumoya awubalwanga. Utyani olukufutshane nesiza esi, lulo oluza kunceda ukuthintela oku, nangona nje lungekho kwiindawo eneenduli zesandi ezithe tshitshilili ngasemantla ale ndawo inesiza.

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6.3.2.4 Izinto ezinxulumene namanzi

Lo mmandla sikuwo isiza uye wahlolwa kufuna ukujongwa amathuba okuba kubekho izikhukhula eziza kubangelwa yimo yezulu efana nokuzala kolwandle, iziphango ezininzi, amaza echweba/idama kunye namaza abangwa ngumoya. Luqokelelwe lwaze lwahlalutywa lonke ulwazi olubalulekileyo, oluquka ulwazi lwangaphambili, olunxulumene nemozulu kunye nolwandle.

Kuye kwenziwa umfuziselo ongumzekelo wezinto ezenzeka kwimozulu naselwandle, oku kusenziwe kuqondwa ukuba zingakhona iindawo olunokusilela kuzo ulwazi olufunyenwe kuyo, kunye nobude bexesha langaphambili elisekelwe kulo olu lwazi, nazo zonke izinto ezatshintshayo ngaphambili kulo mmandla.

Uqwalaselwe nomba wokuba izinto ezininzi zibangelwa zizinto ezahlukeneyo. Umzekelo, uhloliwe nomba wamathuba okuba kubekho izikhukhula ezinokubangwa zizinto ezininzi ezidibanisa ukusondela kwamanzi kakhulu, indima edlalwa ngumoya emanzini kunye nendlela alwatyuza ngayo amaza ngethuba kusenziwa umfuziselo wokujonga izinto ezingayingozi.

Izinto ezinokuba yingozi kwesi siza ezibangelwa zizikhukhulwa zithathwe kula mfuziselo. Izinto ezinokubangela ingozi ngenxa yezikhukhula ziquka umphakamo wamanzi, ubude kunye nexesha elithathwa ngamaza, ixesha esikhutshwa ngalo isilumkiso ngezikhukhula, ixesha elithathwa zizikhukhula kunye neendlela ezihamba ngayo. Izinto ezibangela ukuba amanzi olwandle anyuke kakhulu kunye namathuba okuba oku kwenzeke ngonyaka nazo zibaliwe futhi ziquka umonakalo owenziwa kukuguqu-guquka kwemozulu. Uqwalaselwe futhi wabalwa nomba wamanzi olwandle asezantsi kakhulu.

Uphandiwe nomba wokuba kungabikho zinzo kummandla ongasenxwemeni ngenxa yokukhukuliseka komhlaba okanye ukuqokelelana kwentlenga.

Lwenziwe nophando kulo mmandla kukhangelwa amathuba okuba uhlaselwe yi-*tsunami* okanye yi-*seche* enokuthi ibeke eli ziko lokuphehla inyukliya esichengeni.

1. **Ukukhukuliswa lulwandle**

   Ezi zinto zilandelayo zinxulumene namanzi ziye zahlalutywa zacaciswa ukuze kubalwe inqanaba elinokukhokelela ukuba kuvele ingxaki yokukhukuliswa lulwandle:

   - Ukuzala nokurhoxa kolwandle
   - Iziphango ezimandla
   - Indlela ami nahamba ngayo amaza
   - Amaza amakhulu (aquka ii-*meteo-tsunami*)
   - I-*tsunami*
   - I-*seiche* (ayingeni ndawo kwesi siza)

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Ukukhukuliswa lulwandle kubonwe njengento eyingozi kakhulu ekuza kufuneka ithathelwe ingqalelo kwisicwangciso sokwakha iziko lokuphehla inyukliya, oku kuthetha ukuba udonga olulithambeka kuza kufuneka luphakame kweli nqanaba lilungiselelwe izikhukula okanye kuza kufuneka kwakhiwe udonga lamatye lokuncedisa.

2. Izikhukhula ezibangelwa zezinye izinto ezisuka ngaphandle

Ezinye iintlobo zezikhukhula ekufuneka zithathelwe ingqalelo kwisiza ekuza kwakhiwa kuso iziko lokuphela inyukilya zezo zinokuphazamisa iqondo lobunzulu bamanzi kule ndawo kuza kwakhiwa zingabangeli ntshukumo (ubunzima bamanzi) nokushukuma kwisiphehli-nyukliya. Izinto ezakhe zabonwa kumaziko okuphela inyukliya akhoyo zibubungqina bokuba izikhukhula ezibangelwe zizinto zangaphandle zenza ubuxhaka-xhaka bokuqinisekisa ukuba kukho ukhuseleko bonakale. Uninzi lwalo monakalo lwenziwe kungathathi manyathelo afanelkileyo okuqinisekisa ukuba isiphehli-nyukliya sikhuselekile, ukungayicoci ngokufanelekileyo imibhobho yokuhambisa amanzi kunye nomonakalo owenziwa ngumkhenkce emilanjeni. Amalungiselelo okuthintela izinto ezifana nezi enziwa kwasekuqaleni, ngethuba kusakhiwa.

3. Izikhukhula namaza abangelwe kukungasebenzi kakuhle kwezinto zokugcina amaninzi

Umonakalo onokwenziwa kukungasebenzi kakuhle kweendawo zokugcina amanzi (umz., amadama) uphandiwe. Umonakalo owenziwa kukutshintsha indlela umlambo obuhamba ngayo nawo uphononongiwe. Kukho idama elikhulu (Impofu) eliseKrom River, kumgama omalunga ne-10 km ngasemantla kwisiza. Lo mlambo ukomnye ummango ke ngoko awugaleli kweli cala lineziko lokuphehla inyukliya yiyo lo nto ungenakuba nabungozi kwisiphehli-nyukliya esikwesi siza.

Awekho amanye amadama amakhulu acetywa ukwakhiwa kulo mmandla unesiza kule minyakana imbalwa izayo. Akhona amadama amancinci asezifama akumgama omalunga ne-4 km ukuya ku-5 km emantla esiza. Ukugqabhuka kwedama elisemantla esiza akunakwenza bungozi kweli ziko lokuphehla inyukliya njengoko la amadama akhoyo emancinci futhi iindonga zawo azikho nangaphezulu kwi-5 m ubude.

Ngenxa yokuba kukho amachibi amaninzi kulo mmandla, amanzi amancici nangabaleki kakhulu, mancinci kakhulu amathuba okuba kubekho ukhukhuliseko-mhlaba ngenxa yokuba kutyeka kwiindonga ezibiyele amanzi ke ngoko awunakubeka eli ziko lokuphehla inyukliya emngciphekweni.

Ke ngoko, eli ziko lokuphehla inyukliya alizikuba kwiindawo enemijelo nemilambo emikhulu into leyo inokubeka le ndawo kuza kwakhiwa kuyo emngciphekweni wokuhlaselwa zizikhukhula. Izikhukhula zithintelwa kukuba le ndawo imqengqelezi ke ngoko amanzi ayaqukuqela ukubheka elwandle engekade abe maninzi enze izikhukhula.

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6.3.2.5 Imililo yangaphandle

Lwenziwe uphando ngemililo evela ngaphandle ngeenjongo zokuqinisekisa ukuba eli ziko likhuselekile (umz., indlela yokungena kweli ziko, ukubakho kombane, iindawo zokuphuma umoya, njl njl) kugxininiswa kakhulu kumba onokwenzeka wokuba kucime umbane okanye nayo nantoni enye ingxaki enokwenziwa ngumsi okanye iigesi ezitsarhayo eziyingozi. Imililo yangaphandle yimililo eyenzeka ngaphandle kwamasango eli ziko, umz., umlilo wehlathi okanye wamadlelo kunye nokuchitheka kwe-oli elwandle. Ingxaki enokuvela kukucima kombane kwibhokisi yombane engaphandle (i-LOOP), ukunyanzeleka ukuba imbobo zokuhambisa umoya zesiphehli-nyukliya zibe sendaweni yazo zodwa kunye nomonakalo onokubangela ukuba igumbi elinoomatshini nobuxhaka-xhaka bokulawula iziko lingabi kwimo yokuba lingangena umntu.

Ukuze isiphehli-nyukliya sikhuselwe emililweni kufuneka kuphungulwe izinto ezinokulumekeka zenze umlimo kuze kwakhiwo nezo ziza kuthintela imililo evela ngaphandle ingenzi monakalo.

Imililo apha ngaphakathi kwiziko yona ithintelwa ngokuthi kufakelwe kuze kusetyenziswe amatanki nezinye izixhobo zokucima umlilo nokususwa kotyani olungeyonkulelane kufutshane neziko eli kodwa oko kusenziwa ngokuthi kulandelwe imigaqo nemithetho yezokusingqongileyo. Iza kubekwa phantsi kweliso indlela oza kusetyenziswa ngayo lo mhlaba umelene neli ziko ukulungiselela ukuba imililo evela ngaphandle ingakwazi ukutyhoboza ingene kweli ziko.

6.3.3 Izinto zangaphandle ezenziwa ngabantu

Izinto ezenziwa ngabantu zithathwa ukuba zimpazamo (umz., ukuchitheka kwe-oli kunye nokugqabhuku-dubulo lwegesi eziyingozi). Lwenziwe uphando ngezi zinto zibangela ingozi zihambayo nezingakwaziyo ukuhamba zenziwa ngabantu:

- Iinqwelo-moya ezinokutlitheka kule ndawo inesiza, kugxininiswe kumba wenani leenqwelo-moya ezibhabha phezu kwale ndawo kunye neenqwelo-moya ubuqu. Lwenziwe uphando ngamabala okuhlala iinqwelo-moya kunye nezikhululo zeenqwelo-moya ezikule ngingqi nommandla simi kuwo isiza kuba ukuwa kwenqwelo-moya yomkhosi neyoluntu kule ndawo kucetywa ukwakhiwa kuyo iziko lokuphehla umbane eThyspunt kungenza umonakalo omkhulu kwiziko nakubantu abakufutshane. Iinqwelo-moya ezininzi ziwa xa ziphakama okanye xa zihlala yiyo loo nto izikhululo zeenqwelo-moya kunye namabala okuhlala iinqwelo-moya kuloo mmandla nakule nendawo inesiza zisenza ukuba abe maninzi amathuba okuba iinqwelo-moya zintlitheke kweli ziko.
- Izinto kulo mmandla eziquka ukusebenza, ukuhlela, ukuthuthwa nokugcina iikhemikhali ezinokubangela ukudubula okanye ukuqhashumba. Kuye kwenziwa uphando kulo mmandla kukhangelwa amaziko (kuquka namaziko alapha ngaphakathi kweli ziko lokuphehla inyukliya) agcina, asebenzise, athuthe okanye arhwebe ngezinto ezitsha lula, ezinokudubula, ezirhaxayo, eziyingozi, ezidleka lula ngumhlwa okanye izinto ezinemitha

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enobungozi ekunokuthi xa inokuthi iphume ngempazamo okanye ikhutshwe njengesiqhelo, ibeke ukhuseleko lwesiphehlo-nyukliya emngciphekweni.

- Amaziko anezinto eziyingozi ezinokuphephetheka nomoya ziye kubetha iziko lokuphehla inyukliya.
- Nazo zonke izinto ezinokubangela ingozi (ezimileyo nezihambayo), kuquka nomlilo ovela ngaphandle.

Eyona njongo iphambili yokwenza uphando kukukhangela amaziko ezothutho, oluntu, oshishino kunye nawomkhosi angaphandle kolawulo lomnikazi wawo anokuphazamisa xa kusenziwa izicwangciso zokulungiselela ixesha likaxakeka okanye iintshukumo ezinokwenza ingozi kwiziko lokuphehla inyukliya eliseThyspunt kuze kukhangelwe namaziko anokubangela umonakalo aphantsi okanye nangekho phantsi kolawulo lominiwo ukuze kuqiniskiswe ukuba eli ziko lokuphehla inyukliya alinakubekwa engozini zizinto ezivela ngaphandle ezenziwa ngabantu.

6.3.3.1 Ukuntlitheka kweenqwelo-moya

I-NRR ifuna ukuba indlela elakhiwe ngayo iziko lokuphehla inyukliya ilenze likwazi ukumelana neengxaki ezinokuvela xa inqwelo-moya enkulu yomntu wonke okanye eyomkhosi inokuntlitheka kulo. Iziko lokuphehla inyukliya kufuneka lakheke ngendlela eza kukwazi ukumelana nokuntlithwa yinqwelo-moya ngale ndlela ibilungiselelwe buze ubuxhaka-xhaka balo bezokhuseleko bungaphazamiseki. Lwenziwe uhlolo lwamathuba okuba esi siza sintlithwe yinqwelo-moya kujongwa zonke iimeko eziqondwayo ezinokubanga oku, ingxinano eza kubakho kulo mmandla kwixa elizayo kunye nohlobo lweenqwelo-moya (ezomkhosi nezabucala). Ukusetyenziswa kweendonga ezolekiweyo ezimbini kunye nokusombela isiphehli-nyukliya uninzi lwesakhiwo salo sibe phantsi komhlaba ibe ncinci le ndawo ivelileyo ngaphezulu uwaphungule amathuba okuba eli ziko lifumane umonakalo onokubangwa zizinto ezisuka phezulu ezenziwa ngabantu ezingenakukwazi ukuqikeleleka zize zihlanganiselwe. Ulwazi olungundoqo ngezikhululo zeenqwelo-moya kunye namabala okuhlala iinqwelo-moya lungashwankathelwa ngolu hlobo:

- Ibala lokuhlala iinqwelo-moya laseSt. Francis (elikumgama oyi-10,8 km ngasempuma) lilo kuphela elikumgama oyi-16 km ukusuka kule ndawo inesiza kwaye alihlali rhoqo iinqwelo-moya ezinkulu zabucala nezomkhosi. Akukho zingozi ezenziweyo zinqwelo-moya kweli bala lokuhlala iinqwelo-moya ngokweengxelo ezigcinwe yi-Civil Aviation Authority (CAA) zikhe zenzeka phakathi komhla woku-1 kuJanyuwari 1998 nomhla we-10 Meyi 2008.
- Akukho bungqina bokuba kukho izicwangciso zokwandisa isikhululo seenqwelo-moya, kwaye ngokwale ndlela sisetyenziswa ngayo esi sikhululo kunye nemeko esikuyo ngokwangoku, iziphumo zophando olwenziwe zicebise ukuba inani leenqwelo-moya eziphithizela apha malinyuswe lisuke kwezili-100 ngonyaka liye kwezingama-400

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ngonyaka ukulalisela izinto ezingaziwayo ezinxulumene nokuba libe lininzi inani labantu abafuna ukusebenzisa le nkonzo.

- Isikhululo seenqwelo-moya esinokubalulwa esikude ngomgama ongaphezulu kwe-16 km ukusuka eThyspunt yi-Port Elizabethi International Airport (PEIA) (ekude nge-85 km ngasempuma mntla-mpuma), eyiyo esetyenziswa zizo zonke iinqwelo-moya ezijikeleza apha ekhaya kulo mmandla usemzantsi-mpuma woMzantsi Afrika. Zimbini iinqwelo-moya ezikhe zafumana ingozi kwesi sikhulu ukusuka ngoJanyuwari 1997 ukuya kuMeyi 2008 ngokweengxelo ezikwi-CAA.

Iinqwelo-moya eziphuma zingena e-PEIA zimbalwa kakhulu xa zibalwa kujongwa umgama lo sikuwo esi sikhululo nokuba izinto ezenzeka kuso zingasichaphazela njani esi siza, kusetyenziswa olu hlobo lokubala luthi: $1\,000 \times d^2$. U-d umele umgama olinganiswa ngeekhilomitha osuka kwisikhululo seenqwelo-moya esikhulu uye kule ndawo inesiza. Uphando olwenziweyo lubonakalisa ukuba liza kukhula inani leenqwelo-moya eziza kusebenzisa esi sikhululo kule minyaka izayo kodwa uninzi lwezi nqwelo-moya ziza kuya ngasemantla kuba ziza kube zisingise eRhawutini naseYurophu. Uphando oluqhutyiweyo lubonisa nokuba ukwanda kwenani leenqwelo-moya ezisuka eKapa zisiya e-PEIA akuzikuchaphazela la malungiselelo kuba:

- I-PEIA ikude kakhulu kule ndawo inesiza ke ngoko iingozi ezenzeka kuyo azinakuyichaphazela eli ziko; nokuba
- Iingozi ezininzi zokuwa kweenqwelo-moya zisemoyeni zijongwe ngokolwazi lwangaphambili oluneenkcukacha ngokuntlitheka kweenqwelo-moya phezu komhlaba woMzantsi Afria kule minyaka ili-10 idlulileyo. Akukho bungqina bubonisa ukuba ukwanda kwenani leenqwelo-moya kuza kubangela ukuba lo mmandla ube neengozi ezininzi zokuwa kweenqwelo-moya ezingaphezulu kwezo zenzekayo kwezinye iindawo kweli lizwe.

Indawo yokubhabha iinqwelo-moya emoyeni iphantsi kolawulo lwe-PEIA. Indlela esemoyeni yokubhabha iinqwelo-moya esoloko ixakekile yeyenqwelo-moya ezihleliweyo ezihamba phakathi kwe-PEIA neKapa. Uphando oluqhutyiweyo lucebise ukuba ikhe iphinde iphandwe i-OKSET ukujonga ukuba wamkelekile na lo mgama ukhoyo phakathi kwayo nomzila weenqwelo-moya, njengoko i-IAEA yamisela ukuba lo mgama kufuneka ube yi-4 km ukusuka kwisiza kwiinqwelo-moya.

Inani leengozi zeenqwelo-moya ezenzeka emoyeni nezo zenzeka kwisikhulo seenqwelo-moya zibaliwe. Iingozi ezenzeka emoyeni kumgama ngamnye oyi-km^2 ngaphakathi eMzantsi Afrika zibaliwe kusetyenziswa ulwazi olukwingxelo zangaphambili zeengozi zenqwelo-moya kumacandelwana ahlukeneyo. Izinga lokwenzeka kweengozi, elisekelwe kolu lwazi lukhoyo ngethuba kusenziwa uphando ngemingcipheko ekhoyo lishwankathelwe kuTheyibhile 5.

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ITheyibhile 5: Iingozi zokuwa kwenqwelo-moya zisemoyeni

Uhlobo lwenqwelo-moya	Uhlobo	Ingozi eyenzeke emoyeni nge/km² (50% Confidence Interval)
Eyorhwebo	Air carrier	$1{,}31 \times 10^{-7}$
	Air taxi	$1{,}31 \times 10^{-7}$
Uphapho ngokubanzi	Fixed wing	$1{,}20 \times 10^{-6}$
	Helicopter	$2{,}18 \times 10^{-6}$
Eyomkhosi	Large aircraft	$3{,}00 \times 10^{-8}$
	Small aircraft	$9{,}00 \times 10^{-7}$
	Helicopter	$5{,}00 \times 10^{-7}$

Inani leengozi zokuntlitheka kweenqwelo-moya kwizakhiwo (iziko lokuphela inyukliya) libalwa ngokwenani lazo zonke iintlekele zokuntlitheka kweenqwelo-moya emoyeni nakwisikhululo seenqwelo-moya kwaye lishwankathelwe kwiTheyibhile 6

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ITheyibhile 6: Izihlandlo ekwenzeke iingozi yokuntlitheka kweenqwelo-moya kwiindawo ekwakhiwa kuzo

Aircraft Category	Sub-category	Total Crash Frequency/Year Area of 2 487 ha	Total Crash Frequency/Year Area of 100 ha	Total Crash Frequency/Year Area of 10 ha
Commercial	Air carrier	$2{,}30 \times 10^{-6}$	$1{,}37 \times 10^{-7}$	$3{,}84 \times 10^{-8}$
	Air taxi	$2{,}29 \times 10^{-6}$	$1{,}35 \times 10^{-7}$	$3{,}72 \times 10^{-8}$
General Aviation	Fixed wing	$4{,}09 \times 10^{-5}$	$1{,}73 \times 10^{-6}$	$3{,}83 \times 10^{-7}$
	Helicopter	$3{,}34 \times 10^{-5}$	$1{,}37 \times 10^{-6}$	$1{,}54 \times 10^{-7}$
Military	Large aircraft	$5{,}05 \times 10^{-7}$	$2{,}71 \times 10^{-8}$	$6{,}89 \times 10^{-9}$
	Small aircraft	$1{,}46 \times 10^{-5}$	$6{,}91 \times 10^{-7}$	$1{,}81 \times 10^{-7}$
	Helicopter	$7{,}77 \times 10^{-6}$	$3{,}18 \times 10^{-7}$	$3{,}58 \times 10^{-8}$
Total Crash Frequency for All Aircraft Categories		$1{,}02 \times 10^{-4}$	$4{,}40 \times 10^{-6}$	$8{,}37 \times 10^{-7}$

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Kubalulekile ukuba kuqatshelwe ukuba ukuntlitheka kwenqwelo-moya kubaliwe njengesiganeko esilindelekileyo esilungiselelwa ngendlela ethile xa kuyilwa ezi ziphehli-nyukliya kuza kusekelwa kuzo (uyilo olusekelwe kwizinto ezinokwehla ezaziwayo olusetyenziswayo xa kujongwa ukuba ayophulwanga na imithetho elawula eli candelo), nokuba ezi ngozi zokuwa kweenqwelo-moya zininzi kangakanani na. Isiphehli-nyukliya saseWestinghouse AP1000 kunye neFramatome EPR zombini zakhiwe ngendlela ezenza ukuba zikwazi ukumelana nokuntlithwa yinqwelo-moya enkulu elayisha abant kwaye zinobu buxhaka-xhaka bokuqinisekisa ukuba zikhuselekile:

- Zikwazi ukuqhuba umsebenzi wokuziphelisa ngaphandle kokuncediswa kakhulu ngoomatshini besiphehli-nyukliya;
- Iindonga zokuvala (ii) azidilizwa kukuntlithwa ngamandla yinqwelo-moya elayisha abantu, futhi (ii) liyaqhuba ukusebenza ngokufanelekileyo ngoku sele kukho umonakalo kude kwenziwe icebo uze umonakalo ulungiswe. Amacebo okulungisa awenziwayo ngalowo, ixesha elingaqingqwanga, okuqinisekisa ukuba amanzi okupholisa ayawenza umsebenzi wawo kule ndawo ifumene umonakalo okanye lo ndawo yonakeleyo ivalwe ukwenzela ukuba iqondo lobushushu lilawuleke kunye nemiba enxulumene nomthamo womsebenzi onokuqhutywa sisiphehli-nyukliya ungaphantsi kwalowo eli ziko liwenzayo ngesiqhelo;
- Imeko yetanki lamafutha asebenzileyo (i-UFP): umonakalo owenziwa kukuntlithwa yinqwelo-moya enkulu elayisha abantu kwidonga le-UFP okanye izinto ezilibambileyo awuzikubangela ukuba ivuze le nwebu ingaphakathi ye-UFP ide igqithe kwinqanaba elilelona lincinci lamanzi kweli tanki.

6.3.3.2 Ugqabhuko-dubulo kunye nokuvuza kwegesi ezirhaxayo/ezidlakazayo/nezinobungozi

Lwenziwe uphando ngemisebenzi eyenziwa kulo mmandla equka ukusebenza, ukuhlela, ukuthutha nokugcina iikhemikhali neziqhushumbisi nokuba ingabangela iingxaki ezifana noqhushumbo nokuvuza kweegesi ezirhaxayo/eziyingozi. Izinto ezivela ngaphandle ezinxulumene negesi eziyingozi ziza kwenza umonakalo kwisakhiwo, ubuxhaka-xhaka neentsimbi zesiphehli-nyukliya okanye abasebenzi abasebenza ngoomatshini bachaphatshezwe zegesi eziyingozi, imitha enobungozi, okanye nokuqhushumba bade bangakwazi ukusebenza. Izinto eziyimiqobo kuba zinokwenza ingozi apho iziphumo zinokuthathwa ngokuba ‘zikhuselekile’ kwaye azinakwenza bungozi ebantwini ngenxa yokuba kuvele ingxaki, umz., ukungasebenzi kakuhle kwezakhiwo, zinikwe kuTheyibhile 7.

ITheyibhile 7: Izinto ezithintela izinto ezivela ngaphandle ezinokwenza iingozi

Ingozi	Uhlobo lwengozi	Ubungozi
Umlilo wedama	Thermal radiation (1)	2,9 kW/m^2
Jet fire	Thermal radiation	2,9 kW/m^2
Flash fire	Flammable limits	½ LFL(2)

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Boiling liquid expanding vapour explosion (BLEVE)	Thermal radiation[2]	2,9 kW/m^2
Explosion	Overpressure	2 kPa
Toxic cloud	Concentration	IDLH(3)

6.3.4 UHlolo loMonakalo Onokwenziwa liZiko lokuPhehla iNyukliya kulo Mmandla uneSiza

6.3.4.1 Iinkcukacha ngenani labantu (ukukhula kwenani labantu kunye neendawo abakuzo)

Lwenziwe uphando ngenani labantu ngoku neliqikelelwayo lelixa elizayo kulo mmandla nale ngingqi sikuyo isiza ngeenjongo zokufunda ngefuthe leli liziko lokuphehla umbane licetywa kuluntu lalo mmandla. Iinkcukacha ngenani labantu abakufutshane neThyspunt zifunyenwe kwiStatistics South Africa, i-South African Tourism, amagosa engingqi nawesithili, nangophando oluqhutyelwe kanye oku. Izicwangciso zophuhliso nazo zisetyenzisiwe ngeenjongo zokuba zincede xa kusenziwa uqikelelo ngomyinge eliza kunyuka ngawo inani labantu balo mmandla (izinga eliqikelelwayo lokunyuka kwenani labantu kunye nendawo ezicetywa ukuphuhliswa). Uqikelelo lwenziwe kusetyenziswa izinga lokukhula kwenani labantu kunye nezicwangciso zophuhliso kulo mmandla. Amanani aluqikelelo eentlobo ezimbini zabantu abo bahlala kulo mmandla ngokusisigxina kubekho abo bahlala kule ndawo okwethutyana aye athathwa akadityaniswa ngokolwazi olukhoyo. Unikwe ingqwalasela nomba wabantu abathile abaza kuchatshazelwa ngamandla abatya iintlobo zokutya ezithile kunye neendawo ezithile zona ezidume ngeentlobo zemisebenzi ethile kulo mmandla.

1. Indawo abakuzo abantu ngoku

i) Abantu abahlala apha isigxina

a) Iinkcukacha ngabantu

Uphando lubonisa ukuba abantu abamalunga nama-294 700 bebehlala kumgama ongaphantsi kwi-80 km ukusuka kule ndawo nesiza ngo-2001. Abona bantu baninzi bahlala kwicala lasentshona yomntla-ntshona, emntla-ntshona, emntla, emntla womntla-mpuma, emntla-mpuma nasempuma yomntla-mpuma kule ndawo inesiza (jonga uMfanekiso 18). Iindawo ezinkulu ezihlala abantu zibhalwe kuTheyibhile 8.

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ITheyibhile 8: Iindawo ezinkulu ezihlala abantu kumgama ongaphantsi kwe-80 km (2001)

Indawo	Umgama (km)	Icala	Inani labantu (2001)
Oyster Bay, Umzamowethu	5	W/NW	340
Cape St. Francis, St. Francis Bay, Sea Vista	10 to 15	E/ENE	2 432
Humansdorp, Kruisfontein	15 to 25	N/NNE	17 584
Jeffreys Bay, Pellsrus, Ashton Bay, Paradise Beach	25 to 30	NE	16256
Hankey, Patensie	35 to 45	NNE	15 608
Kareedouw	40 to 50	WNW/NW	3 880
Thornhill	45 to 55	NE	1 667
Woodlands	50 to 55	WNW	1 514
Sanddrif, Nompumelelo Village	65 to 75	WNW	3 019
Portion of the Nelson Mandela Bay Municipality	55 to 80	ENE/NE	207 747

b) Ingxinano yabantu kwiindawo ezihlala abant

Ngokwemigaqo yehlabathi, iindawo ezinabantu abangama-25 000 akufuneka zibe kufutshane ngomgama omalunga ne-6,5 km ukusuka kwindawo eneziko lokuphehla inyukliya, njengoko abantu abangama-200 kwindawo eyikhilomitha ubude nobubanzi kulo mgama umiselweyo kuza kwenza ukuba kubekho abantu abamalunga nama-25 000 (ngumhlaba omalunga ne-16 km onokuhlala abantu abamalunga nama-100 000, oyi-35 k, ngowabantu abangama-500 000 uze oyi-50 km ube ngowabantu abayi-1 000 000) (uMfanekiso 19).

Inkcukacha zobalo-bantu luka-2001 zibonisa ukuba le ndawo inesiza iyithobele le migaqo isisikhokelo.

2. Abantu abahlala ithutyana

Abantu abafana nabo abebeqwalaselwe imeko yabo kulo mmandla waseThyspunt ngabo bantu bahlala ithutyana elifutshane (iintsuku okanye iiveki) kwindawo ethile (efana nendawo yokugxumeka iintente) abaziwayo. Aba bantu abaquki bantu bazihambelayo begqitha kule ndawo.

3. Abantu abangabakhenkethi

Iinkcukacha ngabakhenkethi abaphuma kweli nabo baphuma kumazwe aphesheya abatyelela ummandla waseThyspunt zifunyenwe kwiSouth African Tourism nakwiSebe

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leMicimbi yezeNdalo nezoKhenketho. Iinkcukacha ngabantu abangabakhenkethi nazi ngezantsi.

Inani labantu abangabakhenkethi kwiPhondo laseMpuma Koloni liqikelelwe ngokuthi kubalwe inani labo bavela kumazwe angaphandle bangene eMzantsi Afrika ukusuka ku-2002 ukuya ku-2006 kunye nenani labantu abangena kweli phondo elipapashwe yiSouth African Tourism. Ngokweziphumo zophando, inani eliphele leyo eliqikelelwayo lazo zonke iindawo ezihlala abantu eziboniswe kwiTheyibhile 9 ngabakhenketh/abachithi-ziholide babengama-25 644 ngoDisemba ka-2008.

ITheyibhile 9: Inani elingumyinge labakhenkethi/abachithi-ziholide kwiindawo zikamasipala waseKouga ngosuku ngenyanga kaDisemba 2008[3]

Igama lendawo	Inani labantu abasisigxinas (2008)	Inani labakhekethi bebonke	Inani labakhenkethi xa lithelekisa nabantu balapho abasisigxinia
Oyster Bay	464	1 172	2,53
Cape St. Francis, St. Francis Bay, Sea Vista	3 061	2 563	0,84
Jeffreys Bay, Pellsrus, Aston Bay, Paradise Beach	19 967	12 067	0,60
Iidolophu ezingaselunxwemeni: itotali yazo zodwa	23 492	15 802	0,67
Humansdorp, Kruisfontein	27 094	1 374	0,05
Hankey, Patensie	24 323	7 146	0,29
Loerieheuwel	3 154	0	0,00
Thornhill	2 018	1 322	0,66
Iidolophu ezikude elunxwemeni: ITotali yazo zodwa	**56 589**	**9 842**	**0,17**
Itotali iyonke	**80 081**	**25 644**	**0,32**

Eli liphelele liqikelelwalo lezi ndawo zihlala abantu zingasentla libonisa ukuba yayingabakhenkethi/abachithi-ziholide abangama-25 644 ababetyelele iindawo ezihlala abantu kummandla kamasipala waseKouga ngoDisemba ka-2008. Eli nani lilingana:

- Nomyinge womkhenkethi oyi-0,67 kumhlali ngamnye osisigxini kwezi dolophu zingaselunxwemeni;
- Nomyinge womkhenkethi oyi-0,17 kumhlali ngamnye osisigxina wedolophu ekude nolwandle.

[3] Estimate by Planning Partners (2008)

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4. Indawo eziqikelelwayo ezihlala abantu

ii) Abantu abasisigxina

a) Inani labantu eliqikelelwayo

Ngokwemigaqo efanelekileyo engokwakhiwa kweziko lokuphehla inyukliya, uqikelelo lwenani labantu kufuneka lwenziwe ngeli thuba isiphehli-nyukliya sisasebenza. Ngenxa yesi sizathu, uqikelelo ngesantya sokunyuka kwenani labanttu kummandla okumgama oyi-80 km kufutshane nesi siza lihamba liyokufika ku-2086.

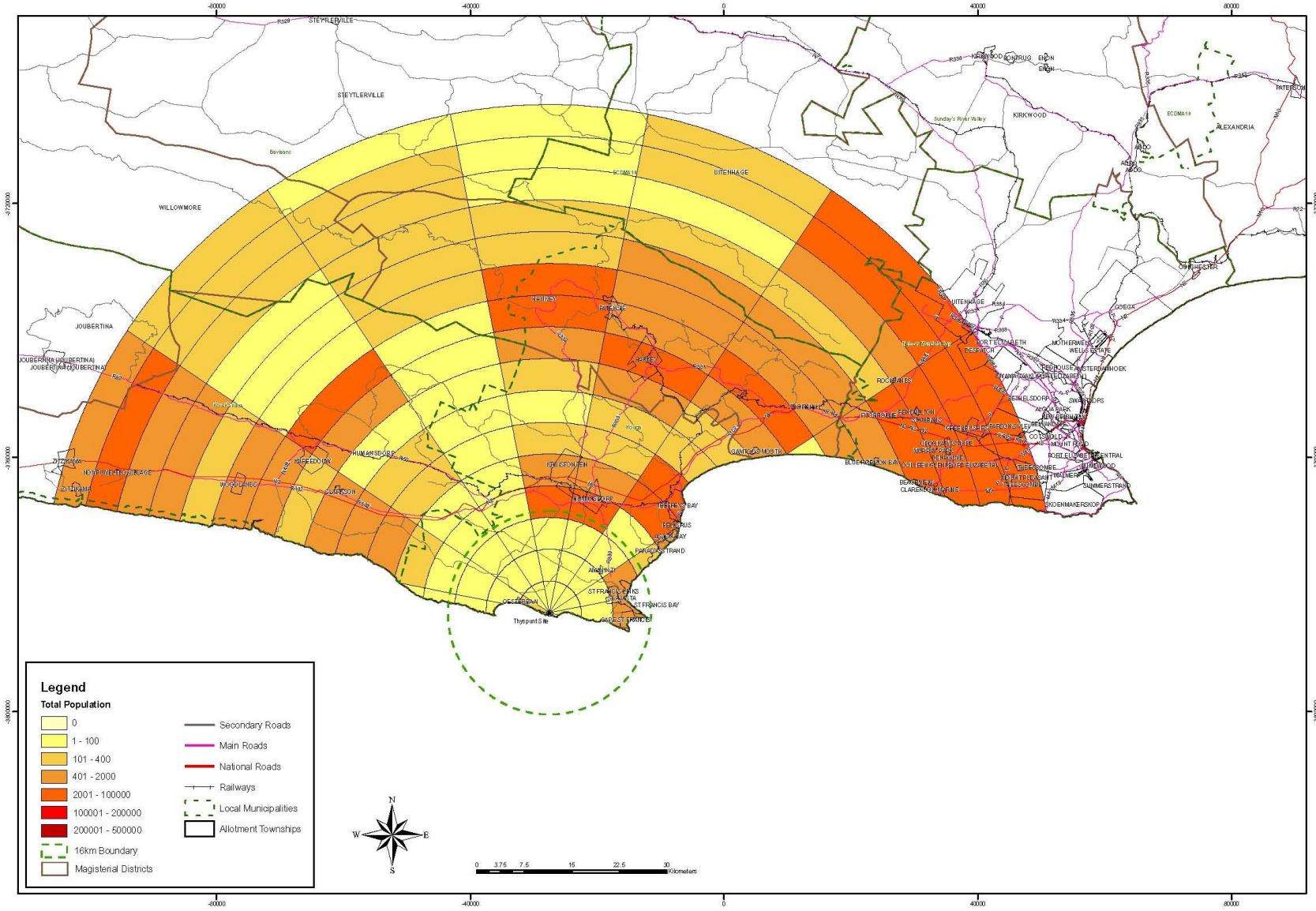
Abantu abangabahlali kumhlaba oyi-6.5 km kulindeleke ukuba babe malunga ne-1 030 ngo-2086. Idolophana encinci engaselunxwemeni ebizwa ngokuba yi-Oyster Bay/Umzamawethu yiyo kuphela indawo ehlala abantu ekumgama ongaphantsi kwe-6,5 km ukusuka kule ndawo inesiza. Le dolophana yayinamabantu abamalunga nama-340 ngo-2001. Le ndawo kuqikelelwa ukuba iza kube inabantu abamalunga nama-870 ngo-2086.

Mancinci kakhulu amathuba okuba kubekho indawo ehlala abantu abangama-25 000 okanye ngaphezulu kumgama ongaphantsi kwe-6,5 km ukusuka kule ndawo inesiza eli ziko lokuphehla umbane lisekhona. Njengoko kukho ithemba lokuba kuza kwakhiwa iziko lokuphehla inyukliya kule ndawo inesiza, ke ngoku kufuneka amaphulo okuphuhlisa nokongeza i-Oyster Bay/Umzamawetho anqandwe. Abantu bebonke abaza kuhlala kumhlaba ongeneno kwi-40 km kuqikelelwa ukuba baza kuba ngaphantsi kwama-140 500 ngo-2086.

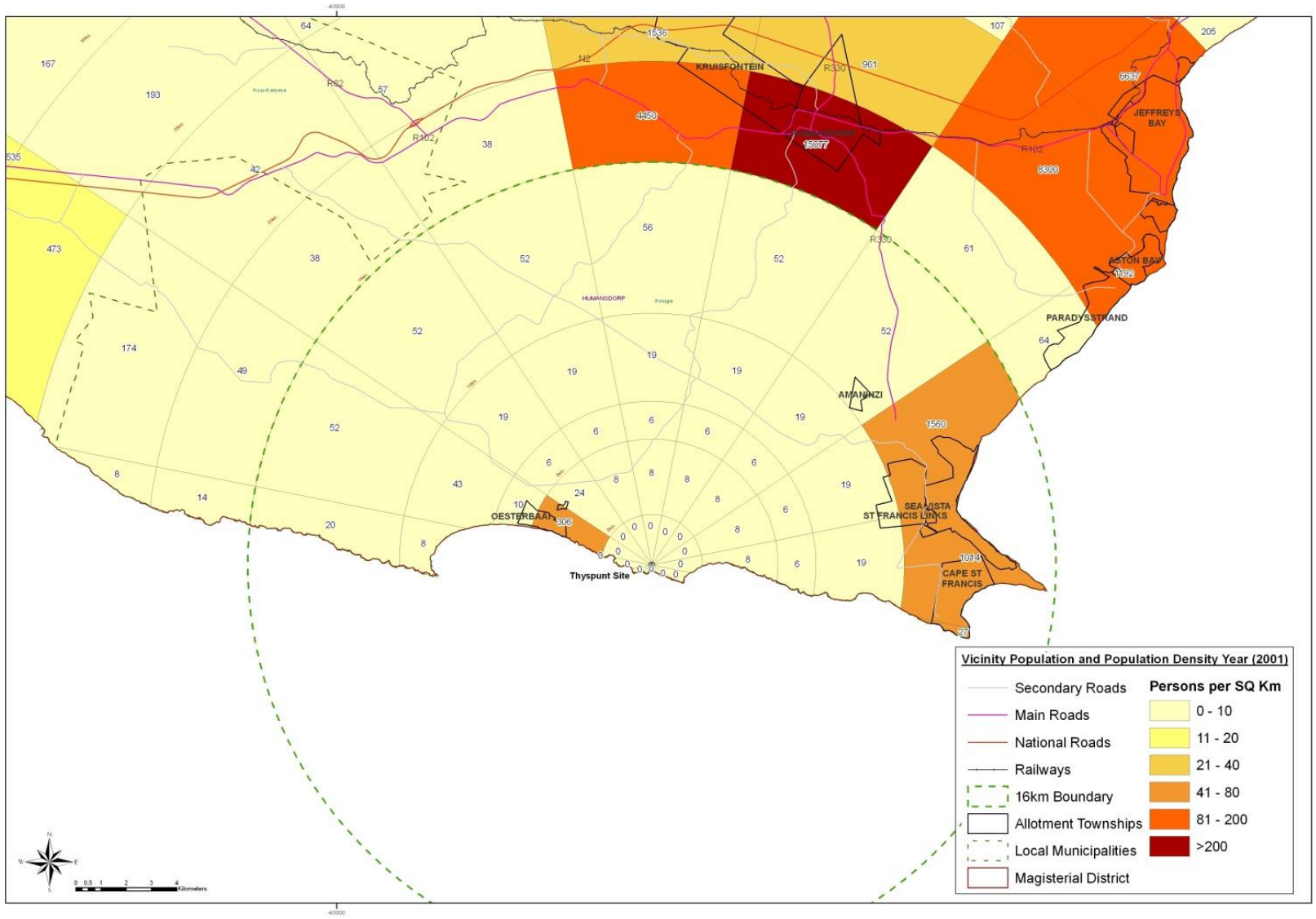
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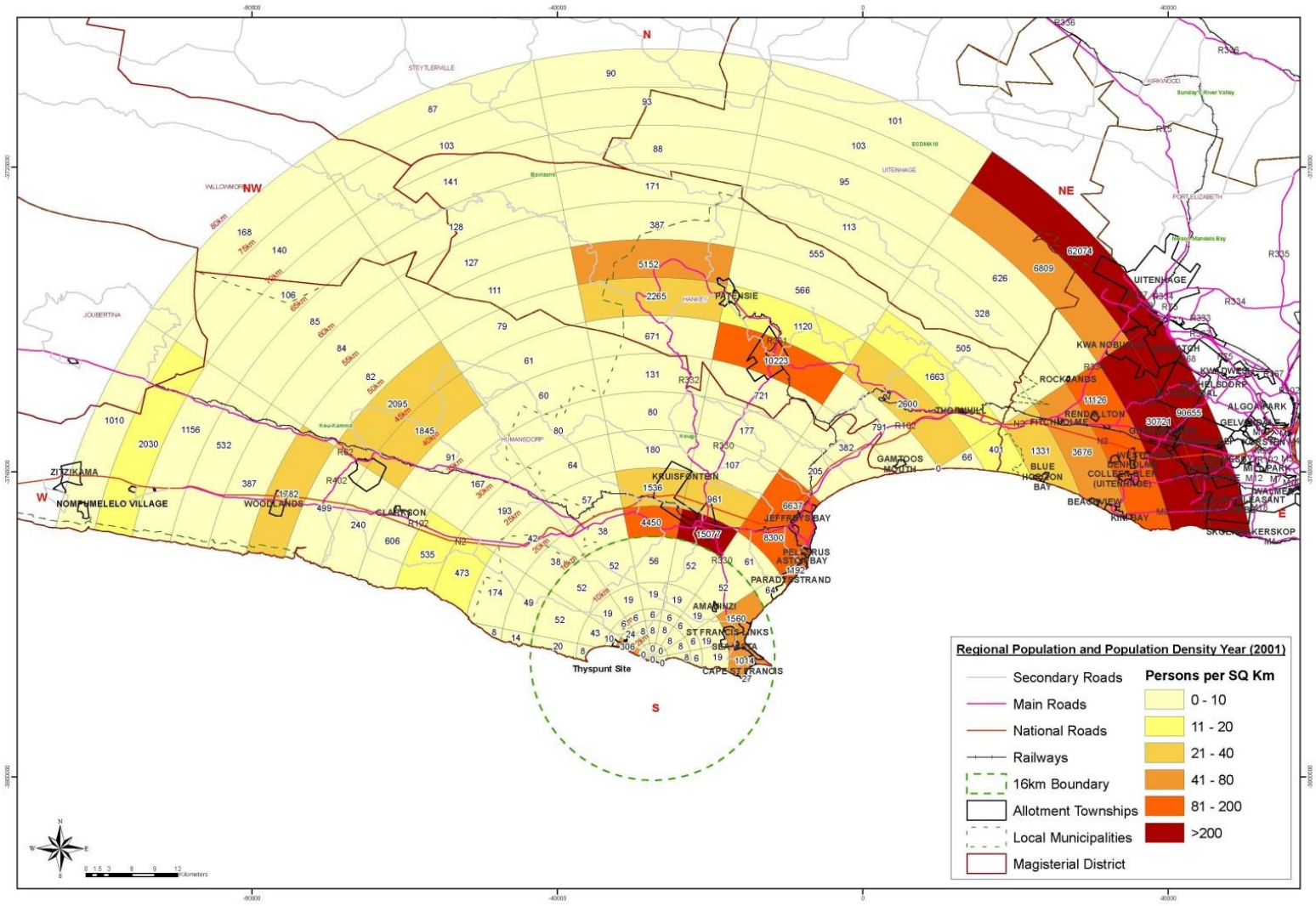
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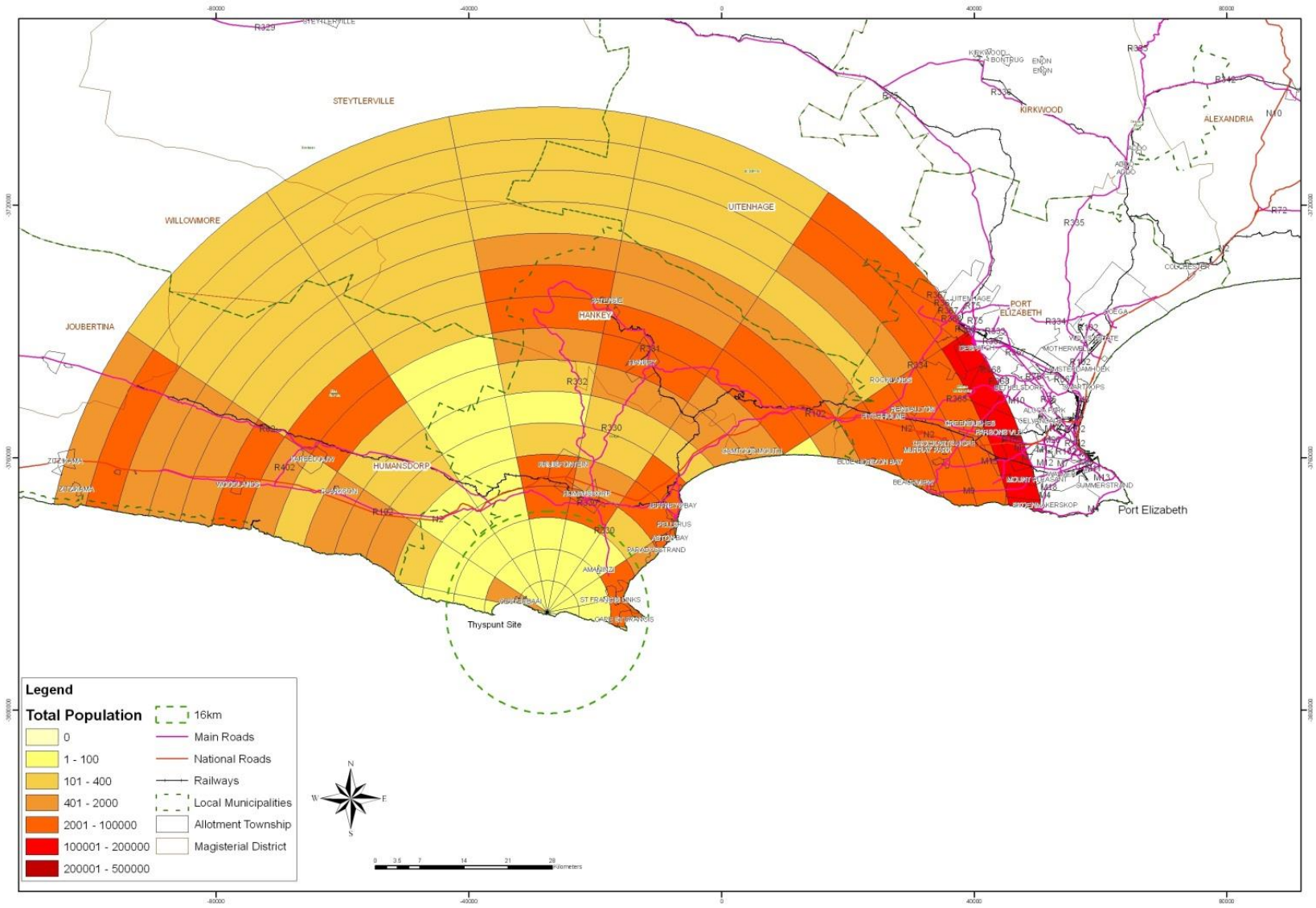
UMfanekiso 16: Iindawo ezihlala abantu kumgama ongaphantsi kwe-5 km eThyspunt (22,5° radial grid) ukuya ku-80 km (2001)



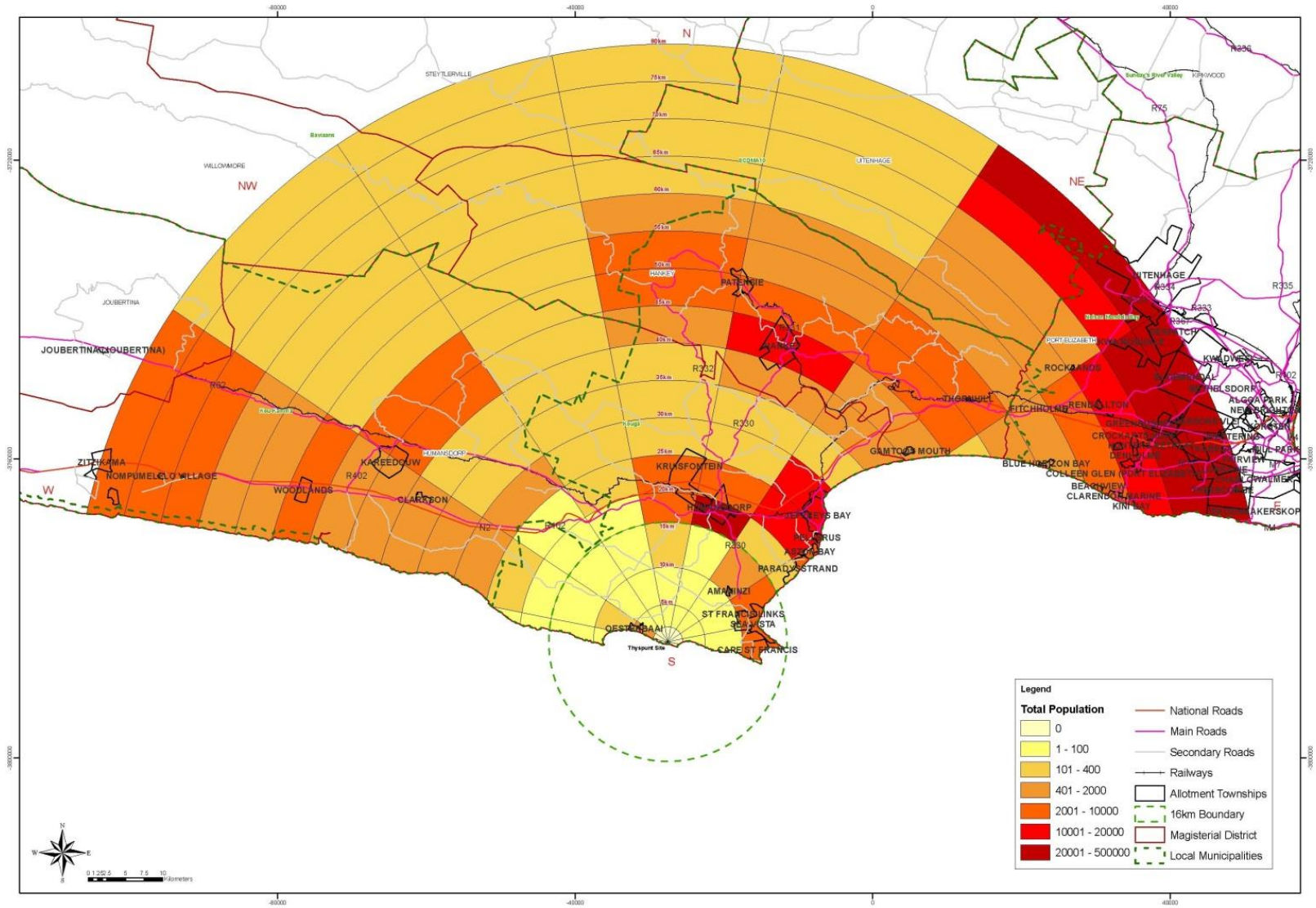
UMfanekiso 17: Inani labantu bale ngingqi neqondo lengxinano yabo (2001)



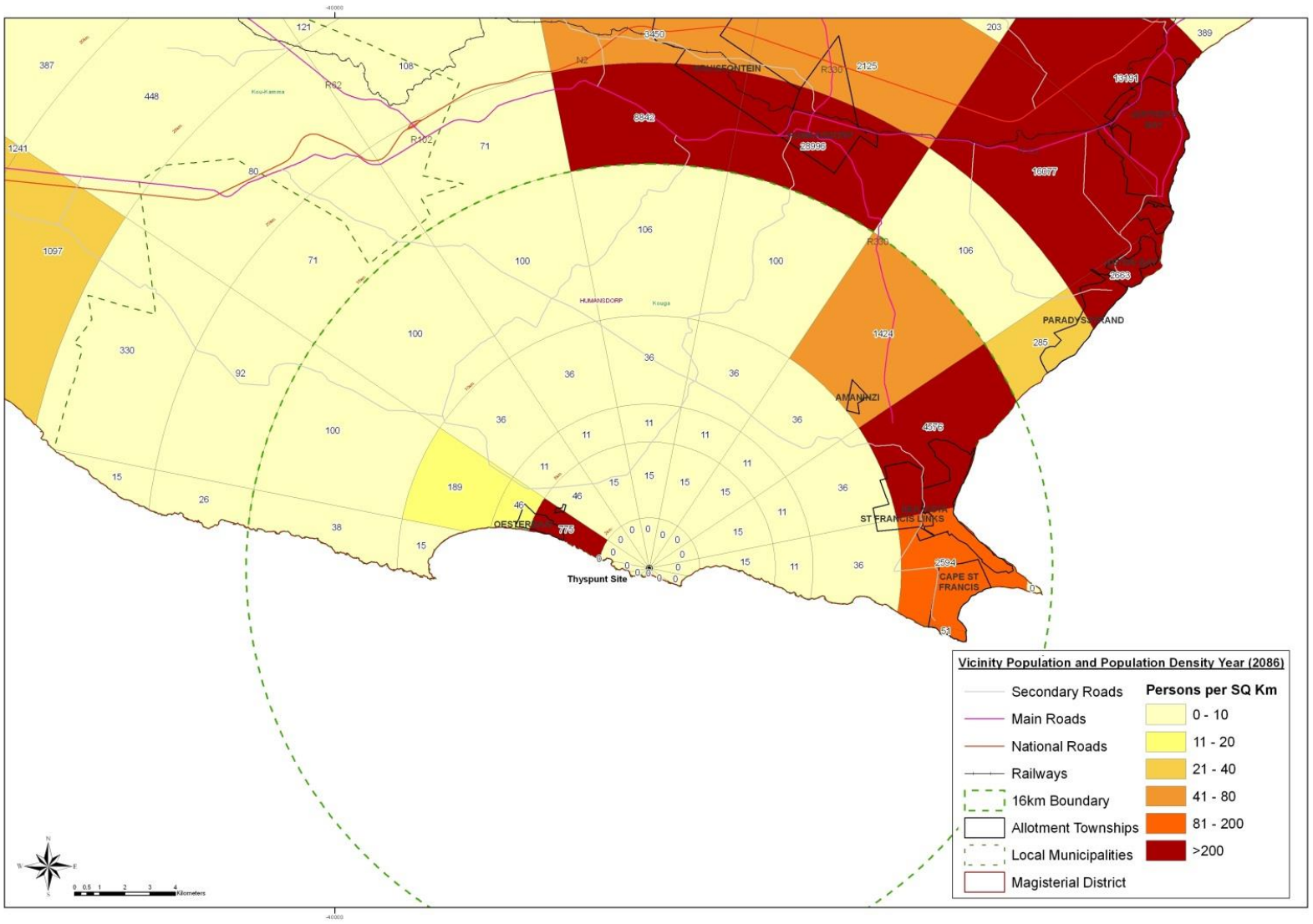
UMfanekiso 18: Inani labantu bale ngingqi neqondo lengxinano yabo (2001)



UMfanekiso 19: Inani labantu bebonke abakhe bakumhlaba okumgama ongaphantsi kwe-5 km eThyspunt (22,5° radial grid) ukuya ku-80 km (2008)



UMfanekiso 20: Inani eliqikelelwayo labantu abakumgama ongaphantsi kwe-5 km eThyspunt (22,5° radial grid) ukuya ku-80 km (2086)



UMfanekiso 21: Inani labantu bale ngingqi bebonke kunye neqondo lengxinano yabo (2086)

6.3.4.2 Umsebenzi woMhlaba naManzi

Zicacisiwe izinto osetyenziselwa zona umhlaba namanzi ukuzwe kuhlolwe iziphumo zokwakhiwa kweziko lokuphehla inyukliya kulo mmandla ingakumbi malunga nokuqulunqwa kwezicwangciso eziza kusetyenziswa ngexesha likaxakeka. Olu phando luqhutyiwe luquke umhlaba neendawo ezihlala amanzi asetyenziswa ngabantu okanye ezinokuba ngamakhaya eziphili ezithile ezibalulekileyo kwindalo.

Umhlaba kumgama ongaphantsi kwe-16 km ikakhulu usetyenziselwa ukulima, kumaxa amaninzi osetyenziselwa iifama zeenkomo zobisi kunye neentlobo zolimo ezifana nofuyo lweenkomo zenyama kunye nokulima ukutya kwemfuyo. Isithili saseHumansdorp sivela umthamo omalunga ne-20% wobisi lweli lizwe futhi ubisi lweli lizwe olumalunga ne-40% luveliswa eMpuma Koloni. Kukho imizi-mveliso yebisi emininzi kumgama ongaphantsi kwe-16 km ukusuka kule ndawo inesiza, ingakumbi kweli cala lingasentshona yomntla-ntshona, elisemntla-ntshon kunga nangasemntla-mpuma. Ubisi luyathuthwa lusiwe kwimizi-mveliso yobisi emikhulu eHumansdorp naseBhayi.

Ezinye iimveliso zolimo nofuyo ziquka iigusha kumgama oyi-2,5 km ngasemntla-mpuma kunye nezilwanyana zasendle kumgama oyi-10 km ngasemntla-mpuma.

Iziqhamo nemifuno zona zilinywa ikakhulu kummandla weGamtoos River Valley kufutshane neHankey nePatensi, kumgama ophakathi kwe-30 km ne-55 km ukusuka kwesi siza.

Kukho iidolophana zokuchitha iiholide ezingaselwandle kule ngingqi inesiza. I-Oyster Bay ikumgama ongaphantsi kwe-5 km ngasentshona yale ndawo inesiza, ize yona iCape St. Francis neSt. Francis Bay zibe kumgama omalunga ne-12,5 km ngasempuma. Iidolophu ezingaselunxwemeni zibalulekile kwaye zizidolophu ezaziwayo zokutyelela abakhenkethi. Ezinye iidolophana ezikumgama ongaphantsi kwe-20 km ukusuka kule ndawo inesiza ziquka iHumansdorp ngasemazantsi eJeffreys Bay (eParadise Beach). Kulindeleke kube ukukhula kunye nophuhliso olungephi oluza kuqhutywa ngumasipala kwiidolophu ezikumgana ongaphantsi kwe-16 km ukusuka kule ndawo inesiza. Owona msebenzi mkhulu wolwakhiwo uza kwenziwa ngumasipala uza kubaseHumansdorp naseJeffreys Bay.

Akulindeleke ukuba itshintshe kakhulu le nto usetyenziselwa yona umhlaba. Izicwangciso zokuphuhlisa umhlaba zibonisa ukuba unxweme lwale ndawo inesiza luthathwa ngokuba lubaluleke kakhuku kumaphulo olondolozo lwendalo, ukhenketho kunye nezolonwabo. Zikwagxininisa nokuba umhlaba wasemaphandleni nowokulima kufuneka ugcinwe kangangoko kulungiselwe amaphulo ezolimo.

Umhlaba omalunga ne-1,2% unamanzi. La asetyenziselwa ukunkcenkceshela nokusela kulo mmandla unesiza. Uninzi lwawo athunyelwa kumasipala ombaxa waseNelson Mandela Bay nge-Algoa Water Supply System. Amanzi aphantsi komhlaba abaluleke kakhulu kwidolophu ezikufutshane nonxweme nakule ngingqi isemazantsi yalo mmandla. Iidolophu ezisebenzisa amanzi aphantsi komhlaba njengamanzi okusela ziquka iHumansdorp, St Francis Bay, Cape St.

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Francis, Oyster Bay kunye neeJeffreys Bay. Elona dama likhulu lisematyeni aphantsi komhlaba lenziwe ngamatye entlabathi ankum-nkum liluhlobo lwe-Table Mountain Group Aquifer.

Amanzi okunkcenkceshela umhlaba wokulima afunyanwa kwimilambo yalo mmandla kunye namadama amakhulu amathathu angala: Kouga, Churchill kunye ne-Impofu. Ayasetyenziswa namanye amadama amancinci kunye noomatshini bokutsala amanzi phantsi komhlaba kwimisebenzi yokunkcenkceshela.

6.3.4.3 Umsebenzi wolu lwandle olukufutshane

Izilwanyana zaselwandle ezifana ne-squid, unamvuna, kunye neentlanzi ziyalotywa kulo mmandla zithengiswe. Ukulobela ukuzonwabisa kuthandwa kakhulu futhi kuyenziwa kwiindawo zonxweme ezivulekileyo kunye ne-ski boats. Iindawo ezinolwandle e-Oyter Bay, St Francisi Bay naseCape St. Francis zithandwa kakhulu ngabakhenkethi. Amaza onxweme oluphakathi kweJeffreys Bay neCape St. Francis athandwa zingcali ze-surfing kwihlabathi liphela.

6.3.4.4 Umonakalo onokwenziwa yimitha enobungozi kuluntu nakokusingqongileyo

Lwenziwe uvavanyo ngengxaki enokuthi ivele yokuvuza kwemitha enobungozi yenyukliya kwiziphehli-nyukliya eziza kwakhiwa kwesi siza kunye nomonakalo onokwenziwa yimithi enobungozi yenyukliya kuluntu nakokusingqongileyo.

Injongo yoku ibikukubonisa ukuba kungafikelelwan kulo mlinganiselo umiselweyo womyinge wonyaka ovumelekileyo ukuba uluntu luwuphefumle ngokwemigangatho yesizwe yokhuseleko. Ukongeza kolu hlolo beluqhutyiwe kujongwa umonakalo onokwenziwa yimitha enobungozi yenyukliya ebantwini, lwenziwe nolunye uvavanyo kujongwa ingozi enokwenziwa yimitha enobungozi yenyukliya kwezinye izidalwa zona ezingengobantu.

Ibaliwe imilinganiselo yonyaka eyahlukeneyo yabantu. Lwenziwe nophando ngemilinganiselo yamaqela abantu abampilo ingentlanga gqibi kwiindawo ezilishumi ezahlukeneyo ezimelene nesi siza. Athathelwe ingqalelo onke amaqela abantu ngethuba kuqikelwe ingozi enokwenzeka xa imitha enobungozi yenyukliya ivuze ngezi ndlela zilandelayo:

- Le mitha inobungozi yenyukliya yesiqhelo ibhabha emoyeni kunye nesemanzini
- Ephuma ixesha elifutshane xa kulungiselelwa okuthile
- I-*gamma radiation* evela ngqo ngaphandle

6.4 IZINTO EZAFUNDWAYO KWISIGANEKO SASEFUKUSHIMA

Izinto ezafundwayo kwisiganeko saseFukushima kunye nezinye iziganeko ezifana zithathelwe ingqalelo ngethuba kusenziwe uphanda ngesi siza. Ezi zilandelayo zingena kakhulu apha:

- Ukucima kombane kwiziko (i-LOOP) kunye nokungasebenzi kobuxhaka-xhaka bombane bokulalelisela kungenza umonakalo omkhulu kakhulu.

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- Kwafumaniseka ukuba iyingozi kakhulu ingxaki yokungena kwamanzi olwandle agcwalise isiphehli-nyukliya kwaye kufuneka ithathelwe ingqalelo xa kusenziwa umzobo wesicwangciso sokwakha iziko lokuphehla inyukliya, oko kukuthi, ithala eli kufuneka libe lide kunalo mgca ubekweya wezikhukhula, okanye kuza kufuneka kwakhiwe udonga lokukhusela apha phambi kwethala.
- Ukungahambi kwamanzi okupholisa (oko kukuthi, ukungangeni kwamanzi olwandle okupholisa) kungabangela ukuba bungasebenzi ubuxhaka-xhaka bokukhupha ubushushu obugqithisileyo.
- Ukungasebenzi kobuxhaka-xhaka bonxibelelwano kunye nezithuthi kwiziko lokuphehla inyukliya kungaziphazamisa izicwangciso ezilungiselelwe ukhuseleko ngabo basebenza ngoomatshini kunye nezexesha likaxakeka ngokuthi kuvaleke iindlela zokuphuma xa kukho ingxaki nokuba iziko eli livalwe ingekade imeko ibe maxongo kakhulu, oku ke kukhokelela kwingxaki yokuqhawuka kweengcingo zonxibelelwano.

Uninzi lwezi zinto zifundiweyo ziza kuhlolwa kujongwe ukuba zingasetyenziswa njani kolu hlobo lweziko lokuphehla inyukliya liza kwakhiwa kwesi siza. Oku kuza kwenziwa xa sele kufikwe kwinqanaba lokufaka isicelo selayisenisi.

6.5 ULUVO NGOHLOBO LOPHANDO OLWENZIWEYO NGESI SIZA

Kuqhutywe uphando olunzulu ngesi siza siseThyspunt sokwakha iziko lokuphehla inyukliya olunxulumelene nezinto ezibalulekileyo ngesi siza ezinokuba luncedo kwimiba yezokhuseleko kweli ziko lokuphehla inyukliya licetywayo. Lwenziwe uphando ngeempawu zendalo nokungqonge le ndawo okunokuthi kuchatshazelwe yimitha enobungozi yenyukliya enokuthi ivuze ngempazamo ngethuba eli ziko lisenza imisebenzi yalo yesiqhelo naxa linokuthi livelelwe yingxaki.

Zichaziwe zaze zahlolwa izinto zendalo kunye nezo zinokwenziwa ngabantu kulo mmandla unesiza kujonges indima ezinokuyidlala enokubeka eli ziko engozini.

Luqokelelwe laze lahlalutywa ngononophelo kujongwa nokuba luthembekile na, luchanekile kwaye lugcwele ulwazi neenkcukahca kusetyenziswa ubuxhaka-xhaka ngeziganeko zendalo kunye nezinto ezibangwa ngabantu ezanzeke phambi kokuba izinto zibhalwe phantsi, nezazenzeke ngaphambili kulo mmandla kunye nobunzulu bomonakalo ezawenzayo.

Kusetyenziswe iindlela ezifanelekileyo ezihambelana nemigaqo kunye nemigangatho yehlabathi neyokhuseleko ukuphanda ngobungoz obubangelwa zizinto ezivela ngaphandle, umzekelo, kusetyenziswe indlela yokuhlola enobuxhaka-xhaka bale mihla, nenkqubo ekwiNqanaba 3 yekomiti ephezulu yokuphanda ngeenyikima (SSHAC) ukufunda ngeengxaki yeenyikima ezinokuthi zihlasele esi siza.

Ubukhulu balo mmandla bekusetyenziswe kuyo ubuchule bokuqikelela ubungozi obuhamba nezinto ezivela ngaphandle bebonele ukuba bungaquka zonke iimpawu nezinto ezibalulekileyo xa kuqikelelwa ezi ziganeko zendalo nezo zenziwa ngabantu kubhekiswa kunye neempawu zezo ziganeko.

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Ngethuba kuhlolwa esi siza ukuze kuqikelelwe umonakalo onokwenziwa yimitha enobungozi yenyukliya kulo mmandla ephuma kwisiphehli-nyukliya ngethuba sisenza imisebenzi yaso yesiqhelo nangethuba kwenzeke ingozi eyimpazamo ezinokufuna ukuba kuthathwe amanyathelo okhuseleko, uye wabonwa umthamo wemitha enobungozi onokuvuza, emva kokuba zithathelwe ingqalelo nezinye izinto ezikufutshane neli ziko liza kwakhiwa kwesi siza kunye nobuxhaka-xhaka balo bokhuseleko.

Lwenziwe uphando zaze zahlulatywa nezinye iindlela ezicwangcisiweyo nezo zingacwangciswanga imitha enobungozi yenyukliya evuzileyo ihambe iye kufika ebantwini nakokusingqongileyo. Konke oku kwenziwe uthathelwe ingqwalasela umba wokuba ummandla ngamnye nesiza ngokunjalo sifana sodwa.

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7 IMIBA ENXULUMENE NOKHUSELEKO

Uphando oluqhutywe eThyspunt luqhutywe ngocoselelo olulindelekileyo kwiiNgcali zeNyukliya futhi luqhutyelwa phantsi kwemeko ehleliwe nenemigaqo, kwaqokelelwa ulwazi olugcweleyo ngeempawu zesiza, kwanikwa nengcaciso ngobuchwepheshe kunye endlela esi siza esiza kwakhiwa ngayo kwaze kwacaciswa nokuba asinazinto sisilela ngazo eziyiyimigqaliselo ezifunwa ngu-Eskom kwaye siyithobele yonke imigqaliselo yezokhuseleko egxininiswa liqumrhu lesizwe elilawula imicimbi yezokhuseleke yenyukliya, oko kukuthi, i-*National Nuclear Regulator (NNR) Act* kunye ne*Regulations on Licensing of Sites for New Nuclear Installations*.

7.1 IINKCUKACHA NGOKHUSELEKO

Uphando nophononongo lwezinto ezivela ngaphandle kweziko laseThyspunt aluniki bungqina buthi malingakhiwa iziko lokuphehla inyukliya kwesi siza. Izinto ezivela ngaphandle ekwenziwe uphando ngazo:

- ziphononongiwe kujongwa yonke kusenzelwa ukuba kungaphinde kubuyelwe kuzo xa kuqukunjelwa izicwangciso zokwakha;
- ziphononongiwe kodwa kwakho izinto ezishiyelelwayo eziza kuqinisekiswa xa sele siqukunjelwe isicwangciso sokwakha; okanye
- ziza kulungiselelwa ngokuthi:
    - kufakwe ubuxhaka-xhaka kumzobo lo wesakhiwo obuza kulalisela
    - kuthathwe amanyathelo okukhusela eli ziko.

Uhlolo oluqhutyiweyo lomyinge onokuvuza wemitha enobungozi lubonisa ukuba umlinganiselo ovuzileyo wonyaka ongenakwenza monakalo mkhulu wabantu abadala nabancinci uphakathi komlinganiselo omninzi ongumyinge wona ongumlinganiselo onganekwenza umonakalo kubantu abadala kunye nomlinganiselo ongumyinge omncinci wona ongumlinganiselo ongenakwenza monakalo ebantweni abanonyaka bezelwe. Umlinganiselo wonyaka oqikelelwayo oya ebantwini abachatshazelwa kakhulu ungaphantsi ku-72 µSv/a. ngenxa yoku, umlinganiselo wonyaka ovumelekileyo ukuba uvuze eendaweni enoluntu ungaphantsi kwalo mlinganiselo ubekiweyo ngokomthetho uyi-250 µSv/a.

Iziphumo zohlolo olwenziweyo lokujonga umonakalo onokwenziwa yimitha enobungozi kwindalo zibonakalise ukuba mncinci kakhulu umonakalo onokwenziwa kwizidalwa ezingengobantu. Akukho nasinye isidalwa esiyinxalenye kwezi bezikhethiwe kwi-ERICA code esibonakalise ukuba sinemitha enobungozi engaphezulu kwe-10 µGy/h.

7.2 INKQUBO YOLAWULO

Inkqubo ebanzi nehlanganeyo yokulawula imiba yokhuseleko kunye nomgangathi yenzelwe ukuqinisekisa ukuba amaphulo ophando nawohlolo aqhutywa apha kwesi siza kuza kwakhiwa

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kuso angqalile futhi ayawenza umsebenzi wawo nokuba imisebenzi yezobunjineli eqhutywa kumanqanaba ahlukeneyo nayo isemgangathweni.

Inkqubo yolawulo iquka, ukuququzelelwa, ukucwangcisa, ukulawula umsebenzi, amabakala emfundo noqeqesho lwabasebenzi, ukuqinisekiswa, kunye nokubhalwa phantsi kolwazi, ngalo ndlela kuqinisekiswe ukuba umsebenzi owenziwa usemgangathweni. Zibhakwa phantsi iinkcukacha zomsebenzi owenziwayo xa kusenziwa uvavanyo okanye uhlolo lwesiza kuwo onke amanqanaba okwakhiwa kweziko lokuphehla inyukliya.

Alandelwe amanyathelo okuqinisekisa ukuba isemgangathweni yonke imisebenzi eyenziwayo enxulumene nokhuseleko okanye xa kusetyenziswa imizekelo eneempawu ezifanayo nezi zeli ziko. Inkqubo yokuqinisekisa ukuba izinto zisemgangathweni iye yahlelwa ngokokubaluleka kokhuseleko kuhlobo lomsebenzi ngamnye owenziwa kweli ziko.

Iqela elihlola isiza lakwa-Eskom linoxanduva lokwenza yonke imisebenzi yokuhlola isiza. Eli qela liquka oosonzululwazi/iingcali ezininzi abanezakhono ezifanelekileyo nabanavama abawufumene kumacandelo afanelekileyo okwenza lo msebenzi. Eli qela liwucacisile umsebenzi ekufuneka wenziwe kwaye lilo ebelikhokela amaphulo ophando kunye nebelithatha izigqibo ngokuba zamkelwe iziphumo zokuphononongwa kweziphumo zeengxelo zokuhlola isiza ezinika iinkcukacha malunga neziphumo zokuhlola isiza.

Ngenxa yokuba ingamacandelo olwazi amaninzi futhi kufuneka nolwazi olunzulu oluvela kwiingcali zamacandelo ahlukeneyo ukuze kunikwe isicwangciso esipheleleyo ngesi siza futhi kubhalwe isikhokelo sezokhuseleko, iqela lokuhlola isiza liye longeza abasebenzi ngokuthi liqesha ingcali ezizimeleyo. Kuye kwatyikitywa izivumelwano zentsebenziswano kunye nezinye iingcali zaseMzantsi Afrika ezizimeleyo. Zonke ezi ngcali kutyikitywe izivumelwano nazo zinkampani ezaziwayo ezisebenza ngeenkonzo zenyukliya kwaye ziye zathathelwa ukuba zenze imisebenzi ethile ezizingcali kuyo futhi nezinamava yokuyenza. Ezi ngcali zabucala zizimeleyo zinezakhono nolwazi olubanzi ngemiba nokhuseleko nomgangatho kanye ngokoluhlobo lufunwa ngu-Eskom nakwi-RD-0034 ye-NNR. Ezi ngcali zesebenzise inkqubo yolawulo yokunyanzelisa ukuthotyelwa kwemithetho eyi-RD-0034 kunye ne-ISO 9001:2008. Ezi nkqubo zolawulo zinika isicwangciso sokukhuthaza, ukuhlola, ukulungisa kunye nokuphuculwa kokhuseleko, ngolo hlobo kuqinisekiswe ukuba wonke umntu uyayiqonda imiba ebalulekileyo yezokhuseleko. Uqinisekisiswe umba wokuba imithetho elawulayo kamasipala ayophulwa futhi nemithetho yesizwe ecatshulwe kwi-NNR enxulumene kanye nalo mba nayo iyathotyelwa. Iye yabhalwa phantsi indlela elandelwe ngayo imiqathango ye-RD0034 kunye neye-RG-10016 (*Requirements for Authorisation Submissions involving Computer Software and Evaluation Models for Safety Calculations*) zingcali ezenza imisebenzi enxulumene nale miqathango yaze inkqubo yokwamkela iziphumo zohlolo yenziwa ngu-Eskom.

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7.3 IINKQUBO ZOKUXHASA UMSEBENZI

Ukulungisella i-NISL, iinkqubo zokuxhasa umsebenzi eziza kusetyenziswa zichazwe nje ngokufutshane. Inkqubo yokuxhasa umsebenzi iza kucaciswa ngokuzeleyo kwi-PID eza kuqulunqwa njengenxalenye yenkqubo ye-NIL.

Inkqubo yokuxhasa umsebenzi (i-OSP) yinkqubo equka iinkqubo ezininzi zokhuseleko, izicwangciso kunye namacebo asetyenziswayo ukulawula indlela elisebenza ngayo iziko ukuze ingophulwa imigaqo elawula ukhuseleko kweli ziko, futhi nazo zonke izinto ebeziqikelelwe ezinxulumene nokhuseleko azitshintshanga. Amaxwebhu kunye neenkqubo ze-OSP aza kubhalwa kulandelwa imiqathango yezokhuseleko ephambili kwinqanaba ngalinye lokufaka isicelo selayisenisi yesicelo se-NISL kwaye aza kuthathela ingqalelo inkampani ekhethiweyo kunye nohlobo lweziko lokuphehla umbane, xa sele egqityiwe. I-OSP iza kulungisa ezi ndawana zilandelayo:

- Uxwebhu olunika iingcaciso ngezinto ezifunwa yi-OSP;
- Inkqubo yokuqulunqwa kwe-OSP;
- Iinkcukacha zobugcisa eziza kusetyenziswa (i-OTS);
- Inkqubo yokulungisa nokukhanda;
- Uvavanyo olwenziwa ngaphakathi;
- Inkqubo yohlolo olwenziwa ngaphakathi;
- Inkqubo yolawulo kolwakheko;
- Inkqubo yokuqulunqwa kwesicwangciso sikaxakeka;
- Inkqubo yokugada ngokusingqongileyo;
- Inkqubo yokuqikelela imozulu;
- Ingxelo yokulungisa nokuphuculwa kokhusuleko kwisiza;
- Inkqubo yokhuselo kwimitha enobungozi;
- Inkqubo yamafutha enyukliya asetyenzisiweyo kunye nokulahlwa kwenkukuma yemitha enobungozi;
- Inkqubo yeengxaki zokusebenza kweziko kunye namanyathelo okulungisa;
- Isicwangciso sokhuseleko olubonakalayo;
- Iinkqubo zokusebenza (ngamaxesha esiqhelo, xa kukho isiganeko, xa kukho ingozi);
- Ubuxhaka-xhaka bokulalelisela nokulwa iingozi ezinkulu

Amanye ala maxwebhu anxulumene nezi zinto zikhankanywe ngasentla angagqityezelwa xa ubuchwepheshe okanye inkampani yabucala sele ikhethiwe njengoko enokuchaphazela

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iinkqubo, inkxalenye yesakhiwo kunye neentsimbi zeli ziko kwanendlela ezisebenza ngayo. Abasebenzi abafunekayo ukubhala nokuphononononga la maxwebhu kufuneka babe bafumane uqeqesho olufanelekileyo baze banikwa igunya lokuba bazingcali kweli candelo ngokweenkqubo zoqeqesho ezifanelekileyo zakwa-Eskom.

7.4 UKUTHOBELA IMITHETHO ELAWULA UKHUSELEKO

7.4.1 IsiCwangciso-sikhokelo semiThetho

Umthetho osetyenzisiweyo ukuba kufunyanwe i-NISL unikiwe kwi-NNR Act (Act No.47 ka-1999), ikakhulu la macandelo:

- U-5(b) walo Mthetho onika i-NNR igunya, phakathi kwezinye izinto, lokuba liqumrhu elimisela imithetho ezakulawula imiba enxulumene nokhuseleko kwisiza, kuyilo, ulwakhiwo, imisebenzi, ukwenziwa kweentsimbi zesiphehli-nyukliya, ukucoca, ukusitshitshisa, kunye nokuvalwa kwamaziko okuphehla inyukliya ngokuthi kukhutswe isigunyaziso sezenyukliya.
- U-20(1) walo Mthetho uthi: "*Akukho mntu unokuhlola isiza, akhe, asebenze, enze iintsimbi zaso, asicoce, asitshitshise/asivale isiphehli-nyukliya ngaphandle kwelayisenisi yeziko lokuphela inyukliya".* Ngokwamasolotya alo mthetho, ukuhlolwa kwesiza, ukwakhiwa, ukusetyenziswa, ukucocwa okanye ukutshitshiswa (ukuvalwa) kwalo naliphi iziko lokuphehla inyukliya kufuneka kugunyaziswe ngelayisenisi yokuphehla inyukliya ekhutswa yi-NNR.
- U-21(1) walo Mthetho ofuna ukuba nabani na ofula ukukhangel aisiza, akhe, asebenze, asicoce okanye avale iziko lokuphela inyukliya angafaka isicela ngendlela emiselweyo yokwenza oko kwigosa eliyintloko yesigqeba se-NNR selayisenisi yeziko lokuphehla inyukliya futhi kufuneka anikwe olo njengoko kuyimfuneko kwibhodi yabalawuli be-NNR.
- U-23 walo Mthetho othi igosa eliyintloko yesigqeba angafakela (futhi atshinshe) imiqathango yale layisenisi efunekayo ukuze kuqinisekiswe ukuba bakhuselekile abantu, ipropati, kunye nokusingqongileyo ekubeni bonzakaliswe yinyukliya, okanye kwenziwe indlela ukuba isiza sihlaziywe size sibuyiselwe kwimo yaso yangaphambili.

Eminye imithetho esetyenziswayo xa kucandwa isiza seziko lokuphehla inyukilya yile:

- R.388 (*Regulation on Safety Standards and Regulatory Practices*)
- R.927 (*Regulation on Licensing of Sites for New Nuclear Installations*)
- RD-014 (*Emergency Preparedness and Response Requirements for Nuclear Installations*)
- RD-0024 (*Requirements on Risk Assessment and Compliance with Principal Safety Criteria for Nuclear Installations*)

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- RD-0034 (*Quality and Safety Management Requirements for Nuclear Installations*)
- RG-0011 (*Interim Guidance for the Siting of Nuclear Facilities*)
- RG-0016 (*Guidance on the Verification and Validation of Evaluation and Calculation Models Used in Safety and Design Analyses*)
- RG-0020 (*Interim Guidance on Emergency Preparedness and Response for Nuclear and Radiological Emergencies*)
- PP-0014 (*Consideration of External Events or Nuclear Installations*)
- PP-0015 (*Emergency Plan Technical Basis for New Nuclear Installations*)

Eminye imithetho ethathelwa ingqalelo iquka:

- Occupational Health and Safety Act (OHSA), 1993 (Act No. 85 of 1993)
- Environmental requirements in terms of the National Environmental Management Act (NEMA), 1980 (Act No. 47 of 1980)

7.4.2 Imigangatho, Izinto ezaziwayo neMigaqo yokuSebenza Esulungekileyo yeHlabathi

Amaphulo ophando kwesi siza siseThyspunt athathela ingqalelo imigangatho nezindululo zezokhuseleko kwihlabathi, kwakunye nezinto ezifundiweyo kunye nemigaqo yokusebenza esulungekileyo ethathwe kwamanye amazwe anamaxa okuhlola iziza nokwakha amaziko amatsha okuphehla inyukliya. Imithombo engundoqo ekufunyenwe kuyo olu lwazi nantsi ngezantsi.

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7.4.2.1 Izikhokelo, imigaqo nemigangatho ye-International Atomic Energy Agency (IAEA)

- *Fundamental Safety Principles, Safety Fundamentals No. SF-1*
- *Site Evaluation for Nuclear Installations, Specific Safety Requirements No. SSR-1*
- *Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants, Safety Guide No. NS-G-3.2*
- *External Event Excluding Earthquakes in the Design of the Nuclear Power Plants. Safety Standard Series, Safety Guide No. NS-G-1.5*
- *Meteorological and Hydrological Hazards in Evaluation for Nuclear Power Installations. Safety Standard Series No. SSG-18*
- *External Human Induced Events in Site Evaluation for Nuclear Power Plants. Safety Guide No. NS-G-3.1*
- *Seismic Hazards in Site Evaluation for Nuclear Installations. Safety Standard Series No. SSG-9*
- *Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants. Safety Guide No. NS-G-3.6*
- *Managing Siting Activities for Nuclear Power Plants. Technical Report No. NG-T-3.7*
- *Site Survey and Site Selection for Nuclear Installations. Safety Guide No. SSG-35*

7.4.2.2 IKhomishini yaseMelika yoLawulo lweNyukliya (i-USNRC)

- *USNRC 10 Code of Federal Regulations Chapter 1, Part 100, Reactor Site Criteria*
- *USNRC 10 Code of Federal Regulations Part 52 (10CFR52) Process for Early Site Permits, Standard Design Certification and Combined Construction and Operating Licence*
- *USNRC Regulatory Guide 4.7 on General Site Suitability Criteria for Nuclear Power Stations*
- *USNRC Regulatory Guide 1.208 Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion*
- *USNRC Regulatory Guide 1.132. Site Investigations for Foundations of Nuclear Power Plants*
- *USNRC NUREG-0800 Standard Review Plan for the Review of Safety Analysis Report (SAR) for Nuclear Power Plants*
- *USNRC NUREG/CR-6966 Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America*
- *USNRC Regulatory Guide 1.27 Ultimate Heat Sink for Nuclear Power Plants*

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- *USNRC Regulatory Guide 1.59 Design Basis Floods for Nuclear Power Plants*
- *USNRC Regulatory Guide 1.70 Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants*
- *USNRC Regulatory Guide 1.206 Combined Licence Applications for Nuclear Power Plants*
- *USNRC Regulatory Guide 1.102 Flood Protection for Nuclear Power Plants*

7.4.2.3 I-Electric Power Research Institute (EPRI)

- *Siting Guide on Site Selection and Evaluation Criteria for an Early Site Permit Application*

7.4.2.4 I-International Organisation for Standardisation (ISO)

- *ISO 9001-2008, Quality Management Systems – Requirements*
- *ISO 14001: 2005, Environmental Management Systems – Requirements*
- *ISO 9225:1992 Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Measurement of Pollution*
- *ISO 9224:1992 Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Guiding Values for the Corrosivity Categories*
- *ISO 17025:2005. General Requirements for Competence of Testing and Calibration Laboratories*

7.4.2.5 I-International Commission on Radiological Protection (ICRP)

- *The 2007 Recommendations of the International Commission on Radiological Protection. Annals of the ICRP, Publication 103*
- *Assessing the Dose of the Representative Person for the Purpose of Radiation Protection of the Public and the Optimisation of Radiological Protection: Broadening the Process. Annals of the ICRP, Publication 101*
- *Age Dependent Doses to Members of the Public from Intake of Radionuclides: Part 5 Compilation of Ingestion and Inhalation Dose Coefficients. Publication 72 Volume 26*
- *General Principles for the Radiation Protection. Annals of the ICRP, Publication 75*

7.4.2.6 I-American Nuclear Standards Institute (ANSI)

- *Criteria for Investigations of Nuclear Facility Sites for Seismic Hazard Assessments. Standard ANSI/ANS-2.27-2008*

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7.4.2.7 I-American Society of Civil Engineers (ASCE)

- *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities. ASCE/SEI 43-05*

7.4.2.8 I-South African National Standards (SANS)

- *SANS 241:2006. South African Standard Code of Practice for the General Procedures and Loadings to be adopted in the Design of Buildings*

7.4.2.9 I-European Utility Requirements (EUR) Organisation

- *European Utility Requirements for Light Water Reactor (LWR) Nuclear Power Plants*

7.4.2.10 Ukuthobela imithetho elawulayo

Iziphumo zephulo lokuya kuphanda ngesiza zihloliwe kujongwa ukuba ziyahambelana na nemithetho yesizwe yolawulo lwenyukliya, ingakumbi:

- U-R.388, ofuna:
  - Umlinganise wenyukliya osetyenziswayo kwilungu leqela eliza kuhlaselwa kakhulu yimitha enobungozi eliyinxalenye yabantu abachatshazelwe yile mitha inobungozi ukuba ube ngaphantsi kwalo mlinganiselo ubekiweyo ongu-250 µSv/a nokuba umlinganiselo obekiweyo ofanele ukuba ufike emntwini ngenxa yokuba ivuze ngendlela ezisemthethweni akufuneki ligqithe ku-1 mSv obekiweyo.
  - Abasebenzi bafundiswe ukuwuxabisa nokuwuphila umba wokhuseleko baze bakhuthazwe ukuba baziqhelanise nokubuza xa bengaqondi bafunde izinto ezintsha ngokhuseleko lwenyukliye.
  - Kwaqaliswa inkqubo yolawulo (iinkqubo zokulawula uveliso lwezinto ezisemgangathweni).

- U-R.927 ufuna ukuba
  - Amaziko amatsha okuphehla inyukliya, abonakalise kwakwimizobo yesakhiwo sakyo, kulwakhiwo lwayo nakwindlela esisebenza ngayo ukuba alungiselelwe ukunciphisa amathuba okuhla kwezinto eziyingozi ezinokukhokelela ekubeni kuvuze imitha enobungozi yenyukliya.
  - Le ndawo sikuyo isiza kunye nobuxhaka-xhaka bezokhuseleko obufakelwe kumaziko okuphehla inyukliya, afakwe njengemanyathelo ezokhuseleko okunthintela ukwenzeka kwezinto eziyingozi ezinokubangelwa zizinto ezingacingelwanga, ziqinisekisa ukuba mancinci amathuba okuba abantu bachaphazeleke kwingozi enokuvela.

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- Esi siza sakhiwe ngendlela yokuba ibe mincinci kakhulu imitha enobungozi yenyukliya enokuvuza kunye neengozi ezinokuvela xa kusenziwa imisebenzi yesiqhelo nezinye izinto eziqikelelwayo ezidityaniswa namaziko okuphehla inyukliya akulo mmandla.
- Enziwe amalungiselelo afanelekileyo okulalelisela izinto zendawo kunye nezo ziyingozi zenziwa ngabantu.
- Izicwangciso ezifanelekileyo zamaxesha kaxakeka kunye nezokhuseleko lwenyuliya ziqulunqiwe.
- Inikwe ingcaciso ngawo wonke umonakalo owenziwa ngamaziko okuphehla inyukliya akule ngingqi kunye nemisebenzi yawo.

- U-RG-0011, ofuna ukuba:
  - Kunikwe isiqinisekiso sokuba isicwangciso sokhuseleko senyukliya (esimalunga nomlinganiselo onokuvuza kunye nobungozi bawo), esinxulumene nokhuseleko loluntu, imigaqo yaso iza kuthotyelwa ngokwezi mpawu sesiza kunye nokusingqongileyo, kunye nolwazi lokuqala olukhoyo ngomzobo osisicwangciso sesakhiwo zala maziko.
  - Iindlela le liza kwakheka ngayo eli ziko ilungiselele nobuxhaka-xhaka obuza kufuneka xa kusakhiwa eli ziko.
  - Kube lula ukuqulunqa nokusebenzisa isicwangciso zexesha likaxakeka kunye nesokhuseleko, kule ndlela siyiyo esi siza futhi nokuyingqongileyo.
  - Kube lula ukwenza amalungiselelo okukwazi ukuzilawula izinto ezenzeka kule ngingqi.
- U-RD-0024, ofuna ukuba
  - Zikhangelwe zize zaziwe izinto ezinokubeka abantu emngciphekweni xa kunokuvela ingozi.
  - Umlinganiselo wemitha enobungozi enokuvuza uye kuluntu kufuneka waziwe.

- U-RD-0034 ufuna ukuba u-Eskom kunye neengcali zakhe ezizimeleyo baqalise ukusebenzisa iinkqubo zolawulo ezihlangeneyo zokulawulo amaphulo ophando aqhutywa kwesi siza nokuba ingxelo eza kubhalwa iqinisekise ukuba kuza kwakhiwa iziko elifanelekileyo.
- U-RD-0016 ufuna ukuba zonke iindlela ekubalwe ngazo okanye nezisetyenzisiweyo ukuhlola izicwangciso zokhuseleko zesisa ziqinisekiswe futhi zibe semthethweni, ngolo hlobo kwaziwe ngokuqinisekileyo ukuba zonke iinkqubo ezisetyenziswa azinanto zisilela ngazo kwaye iziphumo ezizikhuphayo zichanekile.

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8 ISICWANGCISO SOKUHLANGANISELA IINGXAKI EZINOKUVELA ZENYUKLIYA KUNYE NEMITHA ENOBUNGOZI KWAKUNYE NESICWANGCISO SOKUSABELA KUZO

ISICWANGCISO SIKAXAKEKA ESICETYWAYO

Imiqathango yokukhutshelwa ilayisenisi igxininisa ukuba iqumrhu elikhutshelwe ilayisenisi yeziko lokuphehla inyukliya eliza kusebenza okanye elifake isicelo sokwakha iziko lokuphehla inyukliya elitsha kufuneka abonakalise ukuba unaso isicwangciso sexesha likaxakeka futhi esi sicwangciso sesokwenyani. Iinjongo eziphambili zesicwangciso sexesha likaxakeka kwinyukliya nakwimitha enobungozi kukwenza oku kulandelayo:

1) ukuthintela umonakako olindelekileyo onokwenzeka ezimpilweni (ukufa nokonzakala) ngokuthi:
    a. kuthathwe amanyathelo phambi okanye ngokukhawuleza emva kokuvuza kakhulu (umonakalo omkhulu) okanye ukuba kufutshane nesiphehli-nyukliya esivuza imitha enobungozi;
    b. ukugcina umlinganiselo wemitha enobungozi ingaphantsi komyinge omiselweyo onokubangela iingxaki zempilo ezilindelekileyo.
2) Ukuphungula ubungozi obunokubangelwa ziziphumo zezinto ezingalindelekanga kwimpilo (ikakhulu umhlaza nezinye izifo ezibi ezinokufuzwa) ngokuthi:
    a. kuphunyezwe isicwangciso sokhuselo kulandelwa izikhokelo ze-IAEA;
    b. ngokuthi kugcinwe umlinganiselo ovumelekileyo ukuba umsebenzi wexesha likaxakeka alifumane lingaphantsi kweli limiseleweyo ngokomthetho;

Ukuthintela umonakalo olindelekileyo kwimpilo yoluntu kungenziwa ngokuba kuthathwe amanyathelo okhuseleko kwisithutyana nje esifutshane emva kokuvuza kwemitha yenyukilya enobungozi okanye phambi kokuvuza kwayo. La manyathelo kufuneka asekelwe kwindlela elikuyo iziko eli aze aphindwe aqwalaselwe ngokuba emva kokuba kubonwe zonke izinto ezinxulumene nokusingqongileyo. Kungokunjalo nakumalinge okuthintela umonakalo ongalindelekanga kwimpilo yabantu nawo uncishiswa ngokuthi kuthathwe amanyathelo asekelwe kwimo yeziko elo nangokuthi kuphononongwe imeko yendalo esingqongileyo.

Ukulungiselela umsebenzi wokwakha iziko lokuphehla inyukliya (i-NPS), lwenziwe uhlolo kujongwa ukuba siza kusebenza ngokufanelekileyo na isicwangciso sikaxakeka (i-EP) njengenxalenye yokujonga umonakalo onokwenziwa leli ziko kwindalo kunye neyohlolo lokhuseleko lwesiza ethe yakhokelela kwingxelo yomonakalo onokwenzeka kokusingqongileyo (i-EIR) kunye neyokhuseleko lwesiza (i-SSR). Uhlolo lokuba i-EP iza kusebenza na ngenene luyinxalenye yohlolo lwezokhuseleko olubanzi eliye ligcwaliswa futhi licaciswe kwinqanaba ngalinye ala maninzi okukhutshwa kwelayisenisi. Luye lazal isicwangciso sikaxakeka esigqityiweyo esisekelwe kwisicwangciso sokwakha esicacileyo kunye ne-NPS eyakgiwe

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yagqitywa phambi kokuba uqalise umsebenzi omkhulu yona eza kuthi ingeniswe kwi-NNR ukwenzela ukuba yamkelwe.

I-EP iquka amalungiselelo asekelwe kwindlela ecaciswe kwangaphambili yokuqwalasela amanyathelo ahlukeneyo okhuselo kunye nobuxhaka-xhaka obufunekayo bokukhusela kunye nokwazi abasebenzi abasemsebenzini kunye noluntu. La malungiselelo axhomeke kwindawo zokwenza izicwangciso zikaxakeka (ii-EPZ) ezizindawo apho kwenziwa izicwangciso zokulungisa amanyathelo athile okhuseleko wona asekelwe kwizinto eziqikelelwayo ezinokuba yingozi kwimpilo ezibangelwa zezongozi zinoku, phantsi kwemeko ezinzima kakhulu, zivusise imitha yenyukliya enobungozi. Amanyathelo okhuseleko aquka amalinge okunciphisa amathuba okuba uluntu luchatshazelwe yimitha yenyukliya enobungozi evuzileyo ngokuthi luchatshazelwe yile mitha lungaphandle kweziko, luphefumle le mitha iza kube ibhabha emoyeni, lize luyitye ekutyeni xa ithe yatyhobha nokutya. Xa kuthe kwavuza inyukliya, zimbini izinto ekufuneka zenziwe;

- Izinto ekufuneka zenziwe ezibonakalayo (amanyathelo)
- Izinto ezinxulumene nesakhiwo nobuxhaka-xhaka baso (ukuqula ngokwaneleyo)

Amanyathelo athathwayo abonakalayo abhekise kwisakhono sokukwazi ukwenza umsebenzi. Isakhono siquka ukuba namgunya noxanduva, iqumrhu, abasebenzi, iinkqubo, iziko nobuxhaka-xhaka balo, izixhobo, kunye noqeqesho lokunceda ukwazi ukwenza umsebenzi ngempumelelo xa kufuneka ngexesha likaxakeka. Siquka ukuba nazo neziseko zokuncedisa ezifuneayo ngethuba likaxakeka. Iziseko zokuncedisa kule meke zithetha izithuthi kunye nobuxhaka-xhaka bonxibelelwano, imisebenzi emikhulu kunye nazo zonke iziseko umntu anokuzifuna xa kufuneka kuhanjiswe abantu ngokukhawuleza bengaphazanyiswa yinto besuswa kule ndawo ichatshazelweyo, oku kusenziwa ngokukhawuleza kangangoko. Izinto ezingundoqo neziphambili ekufuneka umfaki-sicelo abe nazo ukuze abonakalise ukuba inkqubo yakhe ye-EP ingasebenza zishwankathelwe kwimigaqo elawula isiza ye-NNR u-R927 no-PP-0015.

Njengoko kucacisiwe kule migaqo yokuhlola isiza, xa kukhonjwa futhi kuthathwa nesigqibo ngee-EPZ kuqala kuqwalaselwe iimpawu zesiza, isicwangciso esinomzobo wesakhiwo sesiphehli-nyukliya, uqikelelo lomthamo, uhlobo, ixesha kunye nesithuba esiza kuthathwa yimitha yenyukliya enobungozi ukuvuza kwisihlandlo ngasinye kuvele ingxaki yokuvuza kwale mitha yenyukliya inobungozi. Indlela obalwe ngayo umlinganiselo wemitha yenyukliya enobungozi enokuvuza isekelwe kwindlela esi siza esime ngayo okanye ulwazi ngezinye iziza kunye neenkcukacha ezintsha ngemozulu yale ngingqi kunye nenani labantu bayo. Uhlolo lomonakalo onokwenziwa yimitha yenyukliya enobungozi luza kuthathela ingqalelo nomba weminyaka yobudala yaba bantu bachatshazelwe yile mitha ivuzileyo.

8.1 ISIZATHU SOKUBA ATHEMBEKE AMALUNGISELELO EXESHA LIKAXAKEKA KUNYE NESICWANGCISO SAMANYATHELO AZA KUTHATHWA

Izinto ezijongwayo xa kuqinisekiswa ukuba siza kuphumelela isicwangciso sikaxakeka sisakhono sequmrhu elifana necandelo lolawulo lweentlekele zephondo nezikazwelonke sokukwazi

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ukuthatha amanyathelo kweli xesha libekiweyo ukunqanda umonakalo obunokuthinteleka kwimpilo yoluntu onokubangelwa kukunqashwa yimitha enobungozi yenyukliya. Oku kuthetha ukuba kufuneka kungabikho zimeko zimbi ezinokuphazama amalinge okukhangelela indawo yokuhlala okanye okuhlangula abantu abakulo mmandla okanye kuthintelwa ukuba zingangeni okanye zingaphumi iinkonzo zangaphandle ezifunekayo ukuze kuncediswa kule ngxaki. Inani labantu abakwi-EPZ kufuneka lingabikho ngaphezulu kweli limiselweyo into leyo enokubangela ukuba angasebenzi la malungiselelo enziweyo exesha likaxakeka kunye nesicwangciso sokusabela kwingxaki. Eminye imiba ethathelwa ingqalelo xa kujongwa ukuba amalungiselelo kaxakeka aza kusebenza na yile:

- Umgama ukususka kwisiza ukuya kwiindawo ezihlala abantu;
- Amaqela abantu ekungelulanga ukuba bahlangulwe okanye basiwe kwindawo yokuhlala, la maqela afana nabantu abasesibhedlela, kumakhaya abantu abadala, ezikolweni okanye ejele;
- Izinto ezinxulumene nendlela lo ummi ngawo umhlaba walo mmandla, umzekelo, iziqithi, iintaba, kunye nemilambo enokuthi ichaphazela indlela elihamba ngayo ilifu lemitha enobungozi yenyukliya kunye namalinge okuhlangula abantu kunye nomonakalo onokwenziwa yile mitha inobungozi yenyukliya;
- Imeko yezithuthi zikawonke-wonke kunye nobuxhaka-xhaka bezonxibelelwano;
- Imizi-mveliso emikhulu eyenza imisebenzi enokubangela ingozi;
- Imisebenzi yezolimo nofuyo enokuchaphazeleka lula xa kunokuthi kuvuze imithath enobungozi yenyukliya;
- Ezinye izinto eziyingozi ezinokwenzeka ngexesha elinye nale; kunye
- Nemozulu ngexesha kukho ingxaki.

Iintlobo ezahlukeneyo zobuxhaka-xhaka bokukhusela zifakiwe kwisicwangciso esinomzobo wesakhiwo kwe-NPS ukuthintela iingozi. Olu hlobo lwesicwangciso sokwakha sineentlobo ezahlukeneyo zobuxhaka-xhaka bokukhusela sibizwa ngokuba sesikelwe kukhusela mbombo zonke. Imitha enobungozi yenyukliya ingavuza iphumele ngaphandle kuphela xa kunokuthi kuvele eyona ngozi inkulu kakhulu enokuthi ikhokelele ekubeni bungasebenzi, bufe bonke ubuxhaka-xhaka bokukhusela iziko lokuphehla inyukliya. Icebo lokugqibela lokukhusela abantu sisicwangciso sexesha likaxakeka.

Ulwazi olusetyenzisiweyo ngethuba kuqulunqwa isicwangciso sokusabela namalungiselelo okuhlanganisa ngexesha likaxake lolulungiselela iingozi ezimbi kakhulu kwelo ziko lokuphehla inyukliya luze luldityaniswe nezinto ezifundwe kwiziganeko zokwenyani zokuvuza kwemitha enobungozi yenyukliya ezakhe zenzeka kwiindawo ezithile apha emhlabeni ezifana ne-Three Mile Island (i-TMI), Chernobyl naseFukushima, kwakunye neziganeko zokuvuza kwemitha enobungozi yenyukliya kumaziko angaphehli nyukliya.

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8.2 IINDAWO ZOKUBALEKELA NGEXESHA LIKAXAKEKA

Yindlela ekuqhutywa ngayo kwihlabathi eyokuba kubekho ii-EPZ ezintathu ezenziwe ngezangqa ezintathu ezohlukeneyo ngobukhula ezingaphakathi kwiziko lokuphela inyukliya. Xa kuthathwa isigqibo nge-EPZ, kusetyenziswa ezi ndlela zintathu ukuchaza ezi ndawo zokubalekela zifunekayo (jonga kuMfanekiso 24):

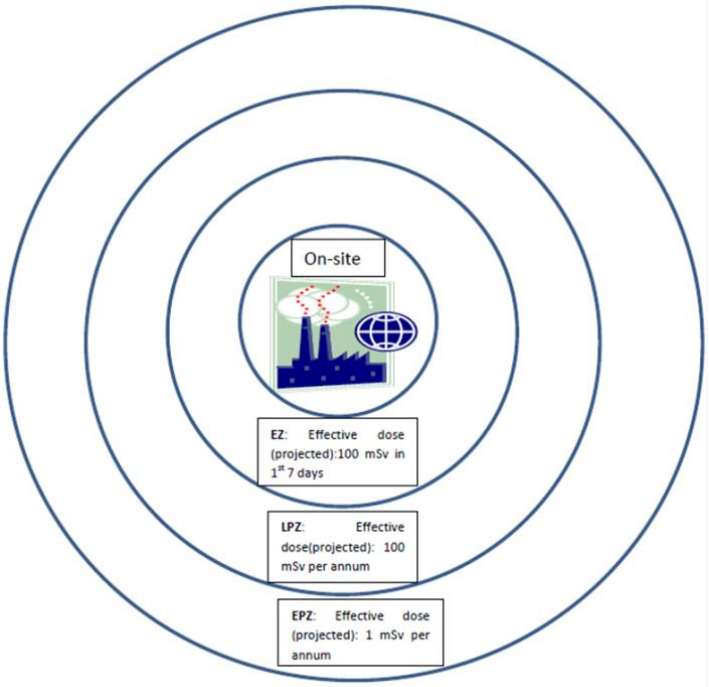
- I-EZ: Umlinganiselo wemitha enobungozi yenyukliya (oqikelelwayo) yi-100 mSv kwiintsuku ezisi-7 zokuqala
- I-LPZ: Umlinganiselo wemitha enobungozi yenyukliya (oqikelelwayo) yi-100 mSv ngonyaka; kunye
- Ne-EPZ iyonke: Umlinganiselo wemitha enobungozi yenyukilya (oqikelelwayo) ngu-1 mSv ngonyaka

Ubukhulu bee-EPZ ezahlukeneyo ubalwa ngokuthi kujongwe iinkcukacha zemitha enobungozi yenyukliya enokuvuza xa kukho ingozi enkulu, ebizwa ngokuba ngamanyathelo okulungiselela ingozi ukuze kuthintelwe umonakalo onokwenziwa yimitha enobungozi yenyukliya empilweni. Ingozi ekusekelwe kuyo ijongwa ngokuba kuthelekiswe zonke iingozi ezinokuchazwa ngokuba zingozi ezinkulu kunye nomonakalo owenzakyo. Ke ngoko, njengoko iintlobo zengozi ezinamathuba amaninzi okuhla zingabi zingozi ezinobungozi kakhulu, lwenziwe uphando olubanzi kuza ukukhangelwa kanye le ndawo ubukhulu bengozi buhambela nomonakalo. Kwi-Generation II PWRs ezininzi, ingozi engumzekelo kusetyenziswa i-98% yezinto ezifundwayo ngeengozi ezimbi kakhulu kwaye ezingozi zenze kube kanye emva kwesigidi seminyaka (10^{-6} ngonyaka) kwaye zenze i-75% yomngcipheko wengozi.

Ukuhlola kunye nokukhetha ubuchwepheshe obufanelekileyo, kusetyenziswa indlela efanayo naleyo yayisetyenziswa ekuqaleni kusakhiwa ubuchwepheshe obuya kuhlala buyinxalenye yesiphehli-nyukliya. Olu hlolo aluzikujonga ixabiso kunye nesicwangciso somzobo wokwaha, koko luza kuqinisekisa ukuba ii-EPZ zinkulu ngokwaneleyo ukuze imisebenzi eyenziwa kwiziko lokuphela inyukliya ingabeki impilozoluntu emngciphekweni kungekho mfuneko. Iinjongo zokumisela ezi zinto kukuzalisekisa ezi njongo zilandelayo:

- Amanyathelo kaxakeka okukhusela akumgama ongaphezulu kwe-800 m ukusuka kwisiphehli-nyukliya ukuba le ngozi ibangele ukuvuza kwemitha enobungozi yenyukliya kungene emoyeni ngokukhawuleza isuka kwisakhiwo esinesiphehli-nyukliya;
- Akukho kulibaziseka okufana nokususwa kwabantu okwethutyana nanini na kumgama oyi-3 km ukusuka kwisiphehli-nyukliya;
- Akukho nyathelo lexesha elide eliquka ukufuduswa kwabantu ngokusigxina (isithuba esingaphezulu konyaka) nandawuni na kumgama ongaphaya kwe-800 m ukusuka kwisiphehli-nyukliya;
- Ukuthintelwa ekutyeni ukutya nezilimo kufuneka kusikelwe ixesha kunye nommandla ukunqanda umonakalo onokwenzeka kuqoqosho.

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UMfanekiso 22: Ubudlelwano phakathi kweendawo ezahlukeneyo ezikufutshane neziko lokuphehla inyukliya (ngokwe-PP-0015)

8.3 AMANYATHELO OKHUSELEKO AKHAWULEZILEYO OKUNCEDISA

Ukuphunyezwa kwamanyathelo okhuseleko angxamisekileyo kusekelwe kumanqanaba amanyathelo abanzi okungenelela (i-GILS), angamanqanaba okungenelela kwelo nyathelo lokuncedisa. Ashwankathelwe kwiTheyibhule 10 kunye namanyathelo owa okhuseleko. Kubalulekile ukukhankanya ukuba le milinganiselo yee-GIL idweliswe ngenzantsi ayiyo nto ingaqhelekanga ifumaneka kuphela kwithetho yoMzantsi Afrika yolawulo lwenyukliya; ithathwe kwi-International Atomici Energy Agency (i-IAEA) kwaye isetyenzisw kwihlabathi liphela.

ITethiyibhile 10: Amanyathelo okhuseleko ahambelana namanyathelo okungenelela kwezinye izinto

Inyathelo lokhuseleko	**INqanaba lokungenelela ngokubanzi**	**Iintsiki ezithathwa yimitha enobungozi isemoyeni**	**Iinjongo zomgama we-EPZ, km**
Indawo yokufihla intloko	10 mSv	2 days	0,8
Uhlangulo	50 mSv	7 days	0,8
I-*Iodine prophylaxis*	100 mGy	—	0,8
Ukufuduswa okwethutyana	30 mSv kwiintsuku ezingama-30 zokuqala ize ibe yi-10 mSv kwezingama-30 ezilandelayo		3

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Ukufuduswa okusisigxina	1 000 mSv	Ubomi bonke	0,8
Ukuvalwa/ukutshintshwa kokutya			40

8.4 UKUZINGOMBA ISIFUBA NGOKUSEBENZA NGOKUFANELEKILEYO KWAMANYATHELO OKUNCEDISA OKHUSELEKO

Kukho ubungqina bokuba xa amanyathelo okuncedisa okhuseleko elandelwe kwangexesha, uyaphunguka umlinganiselo wemitha enobungoz evuzayo ichaphazele uluntu. Ukuphungu kuminganiselo ovuzileyo kuxhomekeka kumanyathelo okungenelela asetyenzisiweyo kunye nexesha elithathiweyo emva kokuba kuphume isaziso esichaza ngengozi engxamisekileyo.

8.4.1 Indawo yokufihla intloko

Ukuze icebo lokukhangela indawo yokufihla intloko lisebenze lisongeza kweli lokusebenzisa amanyathelo okuncedisa nako kuxhomekeka kuhlobo lwesakhiwo, umz., izinto ezisetyenzisiweyo xa kusakhiwa, kwakunye nezinto ezinxulume ne nokukhuswa. Ukukhusa kule meko kubhekisa umlinganiselo ojonga ukuba izinto ezisetyenzisiweyo ukwakha isakhiwo sikwazile na ukuphungula umlinganiselo wemitha enobungozi yenyukliya ukuba ivuze iye eluntwini, into ethetha ngendlela uluntu olukhuseleko ngayo kwingxaki enokuvela yokuvuza kwemitha enobungozi okanye inyukliya.

8.4.2 Uhlangulo

Ukuze umsebenzi wokuhlangula wenzeke ngempumelelo ukuncedisa kwixesha elithathiweyo ukuqalisa ngokuhlangula nako kuxhomekeka ikakhulu abantu bahlangulwe bayakubekwa kude kangakakani na kule nto iyintsusa yengxaki. Eminye imiba efana nemitha enobungozi yesiqhelo ehlala ikho kule ndawo abantu bathuthelwe kuyo kunye nohlobo lotyani zidlala indima encinci kakhulu kumsebenzi wokuphungula umlinganiselo okhoyo xa kuthelekiswa naxa bethuthelwe kwindawo ekude kakhulu. Umgama wobude bendawo abathuthelwa kuyo uxhomekeka kwimozulu (ukuba iyanetha na okanye hayi), umgama ukusuka kwisiphehli-nyukliya apho ubuthathiwe umlinganiselo wemitha enobungozi yenyukliya evuzileyo kunye nomlinganiselo osemoyeni kumgama oyi-1 m phezu komhlaba.

Indawo abathuthelwa kuyo iza kuba kufutshane ukuba kuyanetha kuba amanzi emvula aza kuyihlamba, kodwa iza kuba ninzi phantsi emhlabeni kuba iza kube ininzi ewele kule ndawo ikutshane xa ithelekiswa nengeyiwile ukuba bekunganethi. Ke ngoko ukuthuthwa kwabantu kuza kuwaphungula amathuba okuba bachatshazelwe yimitha enobungozi yenyukliya evuzileyo, into ethetha ukuba ukuhlangulwa kwabantu basiwe kwindawo ekude ngalo mgama uqikelelwe kwisiphehli-nyukliya kuza kuwaphungula kakhulu amathuba okuba babe nezifo ezibangelwa yimitha enobungozi yenyukliya.

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8.4.3 I-Ayodini erhaxayo

8.4.3.1 Isixhobo sokuzikhusela

Ngo-1989, uMbutho wezeMpilo weHlabathi (WHO) waqaliswa uphando ngeendlela zokuphungula umonakalo owenziwayo yi-radioiodine emva kokuvuza kwemitha eyingozi yenyukliya kwiziphehli-nyukliya. Ngo-2010 i-Europena Union yaqalisa uphando nalo olufana nolu kodwa lona lujonga izinto ezininzi ijongo yalo ikukukhusela uluntu xa kunokuthi kuvele ingxaki yokuvuza kwemitha enobungozi yenyukliya. Omabini la maphulo ophando afumanisa ukuba amanyathelo okuzikhusela kwi-ayodini erhaxayo, i-*iodine prophylaxis*, abangwa yi-*isotopic dilution* ne-*saturation*, ezizinto ezisetyenziswa xa izikhusela i-*potassium iodide* (KI): ezi ntlobo zimbini zilwa ne-*radioactive iodine* zisebenzisa umoya wokuhambisa i-ayodini ingene kwithiriyodi. Yiyo loo nto kwiimeko zesiqhelo, i-ayodini egqithisileyo iphungula i-sodium iodide symporter (NIS) kumphezulu weeseli zethiriyodi, ngolo zivalele ukuba i-ayodini ingangeni ngokupheleleyo kwithiriyodi. Ukulawulwa kwe-ayodini egqithisileyo ngexesha elifanelekileyo kuphungula ukuphemlwa kwe-ayodini yethiriyodi e-*radioactive* ngokuthi kuphungulwe i-NIS kuze kunyuswe umthamo we-non-*radioactive iodine* okhoyo wokugcina iiseli zethiriyodi zibambene. Noko kunjalo, nangona inkqubo yokuhambisa i-ayodini esebenzayo igcwala, i-radioidine isenokungena ngenxa yokuba ingafuni eneji ininzi ukuze ikwazi ukungena.

Nokuns kusetyenziswe i-KI okanye i-KIO_3, into esebenzayo yi-*ionic iodide* (I-). I-*iodide ion* isebenza kwithiriyodi ize ithintele ukubamba kwe-radioiodine ngeendlela ezintlanu:

- Nejngesincedisi-luntshintso, i-*substrate,* iza kuxuba i-*radioactive iodine* ejikeleza ngaphakathi emzimbeni okulungele ukuba kungeniswe ngethiriyodi'
- Ngokugcwalisa le khemikhali yokuhambisa i-ayodini ikhokelwa yi-sodium iodide symporter (NIS) ekumphezulu weeseli zethiriyodi;
- Ukuthintela ukungena kwe-iodide kwiiseli zethiriyodi (i-*organification*), into ebizwa nangokuba yi-*Wolff-Chaikoff* (W-C), indlela yokushukumisa i-ayodini ezinzileyo ngendlela i-ayodini ezinzileyo ethi igcwalise ngayo iikhemikhali ezihambisa i-ayodini, ngolo hlobo ibe kanti kuphungulwa ukungeniswa kwe-radioactive iodine kwithiriyodi kuze ngenxa yoko kuphunguke i-*radioactive iodine*. Uphando lubonisa ukuba oku kungakhokelela ekubeni sehle isantya sokuvelisa incindi yedlala lengqula kunye nokuvela kwe-*hypothyroidism*. I-W-C iqhele ukutha ixesha elifutshane, kodwa umntwana ongekazalwa kunye nomntwana omcinci angachaphazeleka;
- Ngokuvelisa i-*organic iodine compound* ephazamisa ukubambana^{131}I;
- Ngokuphazamisa ukuveliswa kwe-*iodine organification* yithiriyodi.

Ke ngoko kubalulekile ukuqonda ukuba iipilisi ze-KI okanye eze- KIO_3 azikwazi ukunqaba ukuba i-*radioactive iodine* zingangeni emzimbeni; zikhusela ithiriyodi yodwa ukuba ingahlaselwa yi-*radioactive iodine*, hayi amanye amalungu omzimba. Ngenxa yoko, i-ayodini ezinzileyo ayikwazi ukuwunyanga umonakalo ubusele wenzekile kwithiriyodi owenziwe yi-radioactive iodine wakuba

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wenzekile. Futhi i-ayodini ezinzileyo ayikwazi ukuwukhusela umzimba kwimitha enobungozi yenyukliya engeyiyo i-*radioactive iodine*.

8.5 UKUPHATHA UKUTYA: AMANQANABA ATHATHWAYO ABANZI

Kungafuneka ukuba kumiselwe imigqaliselo yokusetyenziswa kokutya ngeenjongo zokuthintela ukuba uluntu lungatyi izinto ezidyhobheke yimitha enobungozi yenyukliya. Iimeko ezinokukhokelela ekubeni kuthathwe isigqibo sokuba kumiselwe amanyathelo okuncedisa afana nala, zingahlulwa zibe zindidi ezintathu: ingaba kukhona na okunye ukutya; apho okunye ukutya kunqabileyo; kunye nokuhanjiswa kokutya okusetyenziswa kurhwebo namazwe ehlabathi. Ukumisela imiqathango ngokutya okanye ukuvalwa kokutya ukuba kungatyiwa kwenziwa xa umonakalo owenziwa zintlobo ezithile ze-isotopes kudidi oluthile lokutya ufikelele kwiqondo ebelimiselwe kwangaphambili lomthamo wemitha enobungozi yenyukliya; eli nqanaba lemitha enobungozi yenyukliya libizwa ngokuba linqanaba lokuba kuthathwe amanyathelo abanzi (i-GAL). I-GAL equlunqiwe ukuba isetyenziswa ngamagosa kazwelonke xa ukutya okungokunye okunokusetyenziswa kukhona koku kukuTheyibhile 11. Njengoko kutshiwo, umlinganiselo we-GLA uxhomekeke kuhlobo lokutya kunye nohlobo lwe-radionuclide edyhobhileyo. Ezi radionuclide kubhekiswa kuzo zezo ziyingozi ekutyeni xa kuthe kwavela ingxaki yokuvuza kwazo. Kwiimeko apho kuvalwe iintlobo zokutya ezininzi kunokuba ukuba abantu babetheke esiqwini, okanye xa imeko imaxongo kakhulu bade abantu batyiwe yindlala, kuza kwenziwa uhlolo kujongwa imeko nganye. Kuninzi lweemeko ezifana nezi, kuza kuchazwa ukuba abantu baza kufuduswa kuze kukhangelwe okunye ukutya. Kodwa xa oku kungenakwenzeka, ubungozi obuza nemitha eyingozi yenyukliya kufuneka bujongwe ngokuthi kuqwalaselwe imeko ngamehlo ahlakaniphileyo ngokuthi kujongwe iimeko ezahlukeneyo eziza kukhubaza impilo, futhi kufuneka kuthathwe namanyathelo angqingqwa. Kulandela nayiphi na ingozi enokubangela ukuba kudyhobheke ukutya, kungathathwa amanyathelo ohlukeneyo okuncedisa kumanqanaba ahlukeneyo okulinga nawokuthengisa. Ezi zinto kufuneka ziqaliswe ukuze kuqinisekiswe ukuba kukho ukutya okwanelele, nokuba kuyintoni, kwenziw amatile-tile anakho ukwenziwa. Amanyathelo athathwayo abanzi ngokutya aza kunceda ukuba kubekho nokutya okwaneleyo okuza kuthunyelwa kumazwe angaphandle angachatshazelwanga yile ngxaki, kumaphulo orhwebelwano.

Iziphumo zibonisa ukuba amanyathelo kaxakeka ezi ziphehli-mandla zibini kubhekiswa kuzo awazikonela. Akukho ncedo luvela ngaphandle kwamasango e-NPS aphantsi kolawulo wayo. Noku kunjalo, isicwangciso sikaxakeka esamkelweyo siza kusekelwa kwii-EPZ ezivunywe yi-NNR.

Ukuze abe khona amathuba okuba isicwangciso sikaxakeka esinokwandiswa sisebenze nangaphaya kwemida yee-EPZ ibilinganisiwe, axhomekeke kwizinto elisilela ngazo izinto ezifana nokungabikho kwemiqobo ezakuthintela ukungena nokuphuma kweenkonzo zoncedo ezivela ngaphandle ezinokuthi zifuneke xa kukho ingxaki kaxakeka. Ezi zinto zigwadliwe kweli candela lilandelayo.

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ITheyibhile 11: Inqanaba lamanyathelo abanzi okutya

Ukutya okuza kutyiwa		
Isotope Group	**Radionuclide**	**INqanaba laManyathelo Abanzi (GAL) [kBq/kg]**
1	^{134}Cs, ^{137}Cs, ^{103}Ru,^{106}Ru, ^{89}Sr,^{131}I	1
2	^{90}Sr	0,1
3	^{241}Am,^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu	0,01
Ubisi, ukutywa kweentsana, namanzi		
4	^{134}Cs, ^{137C}s, ^{103}Ru, ^{106}Ru, ^{89}Sr	1
5	^{90}Sr, ^{131}I	0,1
6	^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu	0,001

8.6 UKUHLELWA KWEENGOZI ZENYUKLIYA

Kukho amanqanaba ahlelekileyo amanyathelo athathwayo kwisicwangciso sikaxakeka senyukliya, ngokuxhomekeka kubuzaza beziphuzimo zengozi. Lawo ngala;

- **Isiganeko esingaqhelekanga:** Into engaqhelekanga ebonisa ukutshintsha okungakhange kucwangciswe kwindlela yokusebenza yesiqhelo, okunokuthi kufuneka ukuba kwaziswe umlawuli wecandelo likaxakeka kuze kuqaliswe ukulungisa ubuxhaka-xhaka obuthile besicwangciso sikaxakeka senyukliya bulungele ukusebenza.
- **Isilumkiso:** Kukho imeko enokunwenwa ikhule ide ibe yingxaki yeziko okanye efaka izinto ezininzi efuna ukuva kwaziswe abasebenzi becandelo likaxakeka ukuze benze amalungiselelo okuya edabini.
- **Ingxaki engxamisekileyo kwiziko:** Kukho imeko engxamisekile enokukhokelela ekubeni kuvuze imitha enobungozi yenyukliwa kweli ziko kodwa le ngxaki ayizikuchaphazela uluntu olungaphaya kwamasango asemthethweni eziko.
- **Iingxaki ezingxamisekileyo ngokubanzi:** Kukho imeko engxamisekileyo enokubangela ukuba kuvuze imitha enobungozi yenyukliya ize ichaphazele uluntu ngaphaya kwamasango asemthethweni eli ziko.

Uhlalutyo lokubonisa ukuba isicwangciso sikaxakeka siza kusebenza kufuneka lithathele ingqalelo iimpawu zeziko eli ezinxulumene nendlela eliza kwakhiwa ngayo, umngcipheko nomlinganiselo wemitha enobungozi, iziganeko zangaphandle, iinkcukacha ngemozulu, ukusetyenziswa komhlaba, iinkcukacha-manani zabantu, uphuhliso lwengingqi kunye nokuba olu qikelelo lungentla kufuneka likwazi ukusebenza ngolu hlobo luqikelelwe ngalo lide liyokuguga livalwe eli ziko lokuphehla inyukliya.

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9 INDLELA YOKULAHLA IMVELISO ENEMITHA ENOBUNGOZI ESEBENZILEYO KUNYE NESICWANGCISO SOKUVALA IZIKO

9.1 AMALUNGISELO OLAWULO KUNYE NOKULAHLWA KWEMVELISO ESEBENZILEYO ENEMITHA ENOBUNGOZI YENYUKLIYA

Imveliso esebenzileyo enemitha enobungozi yenyukliya iza kuphathwa ngokwemigqaliselo ye-*Radiactive Waster Management Policy and Strategy for the Republic of South Africa of 2005*.

I-NNR ilawula zonke izinto ezinxulumene nenyukliya kunye nendlela yokuphatha imveliso esebenzileyo enemitha enobungozi yenyukliya ngokomsebenzi wayo ewugunyazisiwe ocaciswe kwi-National Nuclear Regulator Act (1999). Ngokwe-Nuclear Energy Act (1999), iqumrhu elinamagunya okuba liliso kwimveliso esebenzileyo enemitha enobungozi yenyukliya kunye namafutha esiphehli-nyukliya asebenzileyo nguMphathiswa wezaMandla.

Umthamo wemveliso esebenzileyo uza kuxhomekeka kuhlobo elisebenza ngalo iziko elo lombane. Eli liziko lombane licetywayo, elifanayo ne-KNPS, liza kukhupha imveliso esebenzileyo ekumgangatho ophantsi (LLW), ekumgangatho ophakatho (ILW, kunye nekumgangatho ophezulu (HLW). I-LLW kunye ne-ILW zine-*radioisotopes* ezibola ngokukhawuleza xa kubalwa ngokwamaxesha akwanyukliya (i-LLW zithatha iminyaka enokufike kwengama-30 zize kwi-ILW).

9.2 I-VAALPUTS, ISIZA SOKULAHLA IMVELISO ESEBENZILEYO ENEMITHA ENOBUNGOZI YENYUKLIYA

Ngokwe-*National Radioactive Waster Manangement Policy and Strategy*, i- Vaalputs Radioactive Waste Disposal Site eseMntla Koloni, liziko elakhelwe ukulahlala i-L&ILW eMzantsi Afrika. IVaalputs yakhiwe futhi yanikwa imvume yokuba ifake ukuxhaka-xhaka obaneleyo ukuze ikwazi ukwamkela i-L&ILW evela e-KNPS nakulo naliphi na iziko (amaziko) elitsha lokuphehla inyukliya. Indlela yokutshabalalisa le mveliso isebenzileyo inemitha enobungozi yenyukliya yenziwe ngokuthi kusetyenziswe amagunya enyukliya anikezwel yi-NNR phantsi kwe-National Regulator Act, 1999 (Act No. 47 of 1999).

Ngaphambili, iVaalputs, iziko lokutshabalalisa imveliso enemethi enobungozi yenyukliya, yayikade iphantsi kwe-South African Nuclear Energy Corporation (NECSA) eyayinoxanduva loku

Umsebenzi ka-NECSA uza kunikwa i-National Radioactive Waster Disposal Institute eyasekwa njengequmrhu elizimeleyo ngumthetho phantsi kwecandelo 55(2) le-Nuclear Energy Act (No. 46 of 1999) kunye ne-National Radioactive Waster Disposal Institute Act, (No. 53 of 2008) ukuze yenze umsebenzi osemgangathweni ophezulu wokuTshabalalisa okanye ukuLahla iMveliso ezineMitha enobuNgozi beNyukliya, i-*Nuclear Waste Management and Disposal Services in South Africa* egameni likarhulumente.

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9.3 ISICWANGCISO SOKUVALA IZIKO

Xa iziko lokuphehla inyukliya lifikele kwisithuba apho sele lingasakwazi umsebenzi lifuna ukutshitshiswa, ixesha elo limalunga neminyaka engama-60, liza kutshitshiswa, livalwe. Ngokwe-RD-0026, ukuvalwa kweziko kuchazwa njengenyathelo elithathwa ngabalawuli nazingcali elivumela ukuba kususwe yonke imithetho ibilawula iziko (ngaphandle kwecandelo elinolwazi elingavalwa kwaye elingatshitshiswanga). Kumaziko okuphehla inyukliya, ukutshitshisa linqanaba lokugqibela elo ziko lisebenza emva kokuhlolwa kwesiza, ukuzotywa kwesicwangciso sokwakha, ukwakha, ukunikwa imvume yokusebenza, ize ibe kukusebenza. Ngumsebenzi onzima kakhulu lo oquka ukwenza izinto ezifana nophando elinika iinkcukacha ngemitha enobungozi yenyukliya, ukucocwa, kunye nokuqhaqhwa kweziko, izixhobo nezakhiwe, ukudilizwa kwezakhiwo neentsimbi, ukuphinda kulungiswe isiza, kwakunye nokulahla bonke ubugoxo. Zonke izinto ezenziwayo kweli nqanaba zenziwa ngokomthetho obekiweyo kwaye zigunyaziswa yi-NNR (funda kwi-RD-0026) ekuthathela ingqalelo ukubaluleka kwempilo nokhuseleko lwabasebenzi abenza lomsebenzi, uluntu ngokubanzi kunye nokukhuselwa kokusingqongileyo.

Isicwangciso sokutshitshisa iziko eziqulunqwe kulandelwa u-Regulation R.388 no-RD-0026 siza kungeniswa ku-NNR njengenxalenye yesicwangciso esisacetywanyo sokutshitshisa iziko kwakwinqanaba lokwenza isicwangciso somzobo wokwakha kwaye siza kumana sihlaziywa minyaka le iziko lisasebenza lisenza umsebenzi ogunyazisiweyo njengesikhokelo sesicwangciso esityebileyo sokutshitshisa iziko.

Isicwangciso sokutshitshisa eli ziko lokuphehla inyukliya licetywayo singafana nesicwangciso saseKoeberg Nuclear Power Station. Esi sicwangciso sinika ingcaciso ngezi zigaba zingundoqo zokutshitshisa iziko:

Isigaba 1: Amalungiselelo

Esi sigaba siza kuqalisa kwisithuba esiyiminyaka esixhenxe phambi kokuba livalwe iziko lokuphehla inyukliya. Siquka uluhlu olucacileyo lwamalungiselelo (umz., ukubhalwa koluhlu lwezikhundla zeqela leprojekthi yokuvala iziko), amaphulo ophando (umz., uhlolo lomonakalo owenzeke kokusingqogileyo, uphando olujonga ukuphumelela koku olungatyabuliyo ngemali, ukwenza uluhlu lwemithamo yemveliso enemitha enobungozi eza kugcinwa, iindlela zokulawula, ukuhlelwa kweentlobo zemveliso esebenzileyo, kuquka uqikelelo lohlobo lwemveliso esebenzileyo, umthamo kunye neendawo ezikuyo i-*radionuclides* ezibalulekileyo xa iziko sele liyekile ukusebenza, njl njl), iinkqubo kunye neenkcukacha ngobugcisa (umz. ukuvalwa kunye neendlela zokukhupha amafutha esiphehli-nyukliya, amalungiselelo okukhusela abasebenzi bangonzakaliswa yimitha enobungozi yenyukliya, ukulawulwa nokukhutshwa kolwelo negesi esebenzileyo, ukutshatyalaliswa kwemveliso ezinemitha enobungozi yenyukliya, ukugadwa kweli ziko, iinkqubo zikaxakeka kunye nokhuseleko lwabasebenzi abalapha), kunye nokwakhiwa kweziko lethutyana eliza kuncedisa ngeli thuba kudilizwayo kuqhaqhwa (umz., indawo enye eza kwenza umsebenzi wokuba liliso xa kuthathwa izixhobo zokusebenza kusenziwa namalungiselelo ezinto eziza kulahlwa kwindawo engekho apha ngaphakathi kweli ziko,

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ukulungiswa kweendlela eziza kuhamba izigadlal ezilayishe imithwalo, ukwenza iindawo zokukhusa ngoku kulayishwa kuthuthwa izinto, ukwakhiwa kwamazikwana okucoca, kunye nokuthengwa kwezixhobo zokwenza imisebenzi efuna ubuchule obuthile.)

Isigaba 2: Ukuvalwa kweziko nokukhutshwa kwamafutha esiphehli-nyukliya

Kuthathwa isigqibo malunga nemihla yokuvalwa kwamacandelo (emva kwexesha lomsebenzi omninzi lasebusika okanye kwinqana elisebenzisa kakhulu amafutha) size siqalise ukusebenza isicwangciso esineenkcukacha zokuvala amasango okokugqibela eziko nokukhutshwa kwamafutha.

Isigaba 3: Kusetyenziswe isicwangciso sokupholisa itanki lokugcina amafutha asebenzileyo

Akuba amafutha ekhutshelwe kwitanki lokugcina amafutha asebenzileyo, isicwangciso setanki lokwahluhla amafutha asebenzileyo siyaqalisa ukusebenza ukuze kwakhiwe ubuxhaka-xhaka obuzimeleyo bokupholisa amafutha asebenzileyo.

Isigaba 4: Imisebenzi yokuvala iziko

Esi sigaba siquka le misebenzi ilandelayo:

- Ukudilizwa kwesiqithi esinguzenzele nezakhiwo zokuncedisa
- Amalungiselelo egumbi elikhuselekileyo; kunye
- Nokuqhawulwa kweentambo zombane.

Isigaba 5: Ukuthuthwa kwamafutha asebenzileyo kunye nokuqhawulwa kweentambo zombane zesakhiwo sokugcina amafutha neendawo zokuncedisa

Emva kokuhlala iminyaka eli-10 kwitanki lokugcina amafutha, la mafutha okugqibela ebegalelwe apha kufanele ukuba ngoku aphole ngokwaneleyo ukuba angakhutshwa kweli tanki. Amafutha asebenzileyo aye akhutshwe asiwe kwitanki lokugcina amafutha nelokuwahambisa ukuze alungelwe ukuthuyelwa kwitanki elikhulu lesizwe. Akuba ekhutshwe onke amafutha ematankini, iziko lingaqaliswa ukucocwa livalwe ngokwezicwangciso.

Isigaba 6: Ukudilizwa kwezo ndonga neepali ezisashiyekile kulungiswe isizwe silungele ukusetyenziswa kwakhona

Ukudilizwa kwezakhiwo ezingabalulekanga kakhulu kuza kuqala akuba amafutha onke ethuthiwe. Iindawo zesiza eziza kuchatshazelwa ngumsebenzi wokudiliza ziza kucocwa ize le ndawo ibinesiza ivunguzwe ngoogandaganda ukuthintela ukuba igangatheke ngolo hlobo kube nzima ukugrumba nokukhupha ubugoxo obuphantsi komhlaba.

Iinkcucacha ezingqalileyo sesicwangciso sokuvala iziko azaziwa okwangoku, ziza kuqukunjelwa sakuba senziwe isicelo sokuvalwa ngokusesikweni kweziko lokuphehla inyukliya.

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10 UKUTHUTHWA KWEMVELISO ESEBENZILEYO ENEMITHA EYINGOZI YENYUKLIYA

UMzantsi Afrika ulilungu le-International Atomici Energy Agency (i-IAEA) ke ngoko usebenzisa imigaqo yezothutho ecaciswe kwi-IAEA (funda kwi-*IAEA Safety Requirements No. TS-R-1* kunye ne-*Specific Safety Requirements No SSR*-6) ngeendlela zokuthuthwa ngokukhuselekileyo kwemveliso enemitha enobungozi yenyukliya efana namafutha esiphehli-nyukliya, imveliso esebenzileyo enemitha enobungozi yenyukliya ekudidi olusezantsi noluphakathi, kunye nentlenga yezimbiwa. Le mithetho ifakwe kwimithetho yoMzantsi Afrika (funda kwi- RG-0007: *Regulatory Guide on Management of Safety, RG-0008: Regulatory Guide on General Transport, and the General Nuclear Safety Regulations (DRAFT*)). Kufuneka kucelwe imvume kwi-NNR egunyazisa ukuthutha nayiphi na imveliso esebenzileyo enemitha enobungozi yenyukliya. Le mvume iquka isicelo selayisenisi yesithuthi senyukliya ukuze sikwazi eso sithuthi ukulayisha amafutha esiphehli-nyukliya isuke kwinkampani eyivelisayo iye ezibukweni elikufutshane neziko lokuphehla inyukliya.

Injongo yokwamkela imithetho yezothutho ye-IAEA nokuyenza inxalenye yemithetho yoMzantsi Afrika "…*kukukhusela abantu, ipropati kunye nokusingqongileyo kumonakalo owenziwa yimitha enobungozi ngethuba kuhanjiswa ngesithuthi imveliso enemitha enobungozi yenyukliya…".* Oku kwenzeka ngokuthi kwenziwe iziphakamiso ezimayelana namatanki okufaka le mveliso isebenzileyo, indlela yokuyikhusa, kunye nokuthintela.

Amafutha esiphehli-nyukliya aza kuhanjiswa ngolwandle kwimigqomo okanye amatanki omeleleyo eyenzelwe kanye lo msebenzi asiwe kwizibuko elikufutshane njengaxa kulayishwe imithwalo emikhulu kakhulu ngokwemithetho ye-IAEA kunye neye-NNR enika ingcaciso ngendlela yokuhambisa ngezithuthi amafutha esiphehli-nyukliya. I-NNR yiyo edlala indima yokubeka iliso lokuqinisekisa ukuba le mithetho iyathotyelwa ngokuthi iqhube amaphulo okuya kuhlola rhoqo futhi yenze nophando. Kwihlabathi akukho ziganeko zazizibi zakhe zenzeka oko kwaqaliswa ukuhanjiswa imveliso enemitha enobungozi yenyukliya, ngenxa yamalinge enziwayo kunye nemali eninzi ebhatalwayo ukuqinisekisa ukhuseleko lukhokela phambili.

Imveliso esebenzileyo enemitha enobungozi yenyukliya (ekumgangatho osezantsi nophakathi) ephuma kwiziko lokuphehla inyukliya iza kuthuthelwa eVaalputs Radioactive Waster Disposal Site. Izicwangciso ezikhoyo zicebisa ukuba ihambe ku-N2 iyokugqitha eKapa ize ithathe u-N7 iye eVaalputs.

11 ISIPHELO

Olu xwebhu lunika uluntu iinkcukacha ezigcweleyo ngale projekthi; imithetho u-Eskom ekufuneka achankcathe kuyo aze ayithobele phambi kokuba imvume esisigunyaziso selayisenisi yeziko lokuphehla inyukliya (i-NISL) kunye ne-NIL ifunyanwe (njengoko ezi izinkqubo ezimbini ezahlukeneyo). Njengoko sekutshiwo ngaphambili, i-NIL sisigunyaziso esingundoqo esivumela ukuba kwakhiwe, uqalise umsebenzi, kulungiswe, kuzo kuze kuvalwe iziko lokuphehla inyukliya ngokobuchwepheshe obuthile. I-PID ehamba nesicelo se-NIL iza kubhalwa sakuba senziwe sicelo se-NIL.

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Enziwe onke amalinge okuqinisekisa ukuba uluntu lufumana ulwazi olubalulekileyo olumalunga nohlobo lwesigunyaziso se-NISL esifakelwa isicelo kunye neengozi ezihamba naso. Bunikiwe ubungqina obubonisa ukuba zonke izinto eziyingozi ezinokubangela i-*ionising radiation* zixeliwe nokuba ezi zinto zingagcinwa zi-ALARA. Ke ngoko kungaqukunjelwa ngelithi isiza esiseThyspunt sichazwe kakuhle xa kusithiwa sisiza esifanelekileyo sokwakha iziko (amaziko) elitsha lokuphehla inyukliya.

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